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The Use of Non-Ferrous Metals in the Electroplating Industry

The Present State of the Art Briefly and Interestingly Reviewed —Supervision Has Already Passed from Foreman to Chemist; the Metallurgist Will Be the Next to Assume Direction of the Work

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AN ADDRESS AT JOINT DINNER OF INSTITUTE OF METALS AND IRON AND STEEL DIVISIONS, CLEVELAND, OHIO, SEPTEMBER, 10, 1929.

IN 1833, less than one hundred years ago, Michael Faraday discovered and stated the laws of electrolysis. His discovery formed the foundation of a new use of metals which has now reached a variety of application not ordinarily appreciated. Furthermore, things can be done with electro-deposited coatings which have thus far defied other methods. Some of the uses of electro-deposited coating are interesting. The tonnage of metals already finding an outlet through such a channel is considerable.

In general electro-deposits have two characteristics: ornament plus utility; utility plus ornament. Both these factors are usually found associated in electro-deposits. Ornament plus utility was probably the first use. For example, the silver-plating of tableware, having its real birth in Birmingham, England, about 1844. However, this same ornament plus utility retarded the development of electro-plating, because in the beginning, electro-plated articles were branded with the odium of imitation and shunned accordingly. The gold brick of the swindler may be an exception to this statement.

When nickel-plating appeared on the scene, while its adoption was primarily on account of its ornamental value, nevertheless its utility, due to its protection of the underlying metal from corrosion, focused attention on the utility value of electro-deposits. The development of electro-refining is too familiar a subject to be reviewed for this audience. However, it is well to point out that the rarer metals are now recovered, in quantities hitherto impractical, through the shift from smelting to electro-refining. Electro-deposition furnishes an excellent ever-ready and ever-growing outlet for these reclaimed metals, and consequently the metallurgist has a real interest in electro-deposition.

Unfortunately electro-forming, that is producing something of solid metal by, let us say, electrolyzing a solution of a salt of the metal, seems limited in scope, because electro-forming is always a slow process and one in which the capital and floor-space investment is high. Only when the nature of the article itself is such that other methods are difficult, or impossible, does electro-forming play its part. In such cases, however, it plays its part well, and such applications put to use an appreciable tonnage of metals. Most familiar is the electrotype of copper, or the so-called, nickel type when formed of nickel. Cheap, easy to make, faithfully reproducing its wax "inspiration," electrotypes are really wonderful metal slabs, and so common that their character is unappreciated.

Thin metal foils are expensive to produce by rolling or other mechanical methods. The cost of such foils increases or pyramids when very thin gages are produced. They can readily be produced, in most metals, by electro-forming and paradoxically, the thinner, the quicker and the cheaper. The nickel flakes of the Edison storage battery are an example of what can be done by electro-forming.

But it is in the field of coatings that electro-deposition plays its important part; a field in which, for example, within a few years, electro-plating has transformed a reclaimed metal, which was a drug on the market, into a position of shortage, and has doubled the selling price. Electro-deposited coatings will probably afford the best and cheapest method of arresting corrosion, especially when an outer metallic surface is desired. Attention is called to the distinction between corrosion and tarnish. Corrosion has to do with the metal underneath the coating; tarnish is an atmospheric discoloration of the outer surface of the coating.

Fortunately, electro-deposition, in aqueous solutions, is a cold process and consequently it can be performed without affecting the temper or crystal structure of the metal on which the deposit is made. It is interesting to point out that electro-deposited coatings are a metallic crystal growth of themselves. The crystals of the coatings build up on the surface crystal structure of the base. This fact, as will be pointed out in a moment, forms a strong link of interest between the metallurgist and electroplater of the future.

The coatings may be roughly separated into the precious metal group, which includes gold, silver, platinum, tantalum, palladium and a few others and the non-precious metal group, including copper, nickel, chromium, zinc, cadmium, lead, tin and, as a bi-metal deposition, brass.

Electro-deposition has gained impetus since the World War for four distinct reasons. First is the utility of electro-deposition disclosed in the making of munitions, for example, the elimination of machine-gun barrel fouling when copper-plated bullets were substituted for the grease-coated varieties. Underweight shells were reclaimed by lead-plating them internally. This method did not destroy the ballistic properties of the reclaimed shell, but it did save both time and money.

Second is the development of labor-eliminating, process-stabilizing, electro-plating machinery. Such machinery has freed the producer from the uncontrollable variables of manual production, lowered the cost, and improved the quality of electro-deposited coatings.

Third, in these days of high color combinations, bright electro-plated coatings play a foremost part. High color combinations will probably exist until our entire mode of living is changed, because it has been demonstrated that color is an important stimulant to the nervous system and that the bull is by no means the only animal which responds definitely to color sensations. Just as sugar forms an important fuel for the human engine, so do high colors and high reflecting surfaces form the stimulus to the nervous system which controls and directs the energies of the mind and body. Sales executives are recognizing the value of appearance as a sales appeal and highly buffed electro-plated surfaces have never been equaled for such effects.

The fourth reason is less obvious but none the less real, and it is that the investment cost of modern electro-plating installations has made it necessary, in most plants, to seek appropriations for the equipment from the higher officials of corporations. Thus these officials have become interested in the possibilities and advantages of plating.

Copper-Plating

It is difficult to define any order of importance of electro-plated coatings. However, let us begin with copper. Copper is used for electrotypes, phonograph record and movietone molds, copper-clad roofing shingles, copper-plated iron and steel articles of all sorts, copper "stop-off" in heat-treating steel, bronze and brass-plated articles, and a veritable host of things too long to be cataloged completely. Electro-deposition, neglecting of course copper refining, now gives an annual outlet for about 500 tons of metal.

Nickel-plated parts are literally legion. Yet a few other uses of nickel deposition are valuable, unique and generally unknown. In place of engraved plates of hardened steel at the United States Bureau of Engraving and Printing, in Washington, printing-plates are made by depositing nickel alternately with copper to produce a shell of sufficient strength to withstand the pressures and mechanical strains to which these plates are subjected. Nickel-plating can be used as a protective layer on steel prior to heat treatment. It does not act as a stop-off in the heat treating process like copper, but it does eliminate the hard heat scale which forms on steel during the heat-treating process.

Protective Value of Nickel

The nickel-plating of sheet steel which is afterward painted, lacquered, or enameled, protects the paints, lacquers and enamels from corrosion of the steel surface underneath the nickel-coating. When nickel is deposited properly and to a sufficient thickness, all of which fortunately happens to be easy to accomplish, its protective value to the base metal lying underneath it is better than is generally recognized. Nickel forms the ideal coating under ornamental chromium-plating and it is doubtful if chromium-plating will ever be commercially successful for such purposes unless it is deposited over a satisfactory coating of nickel. Nickel-plating now takes annually about 2,000 to 3,000 tons of metal.

An idea of the area of metal covered by nickel can be obtained when it is remembered that the average commercial nickel plate is approximately one ten thousandth of an inch thick (0.0001 in.). This means that every ton of nickel deposited covers approximately 433,500 sq. ft., or about 10 acres, of surface, and the total amount used annually covers about 25,000 acres.

The mere mention of chromium suggests electro-deposition. The inherent advantages of chromium coatings for high luster, for resistance to atmospheric tarnish, and for resistance to abrasion has focused an amount of attention on electro-plating far exceeding any degree of interest previously shown in it. This interest has resulted in the betterment of the whole art of electro-deposition. It is significant to call attention to the fact that the use of chromium-plating is very new. Certainly in this country it dates from the World War and did not exist commercially here prior to the war. However, as might be expected with any such rapid and spectacular development, the beginnings of commercial chromium-plating have been marred by over-enthusiasm. For example, at the outset chromium-plating was heralded as the long-sought-for and perfect answer to the problem of corrosion elimination. It soon became evident that thin deposits of chromium are, at the present status of the art, exactly as porous as are thin deposits of any other metal. Lack of porosity in any character of coating applied for corrosion prevention is essential when such protection depends on the exclusion of moisture from the base metal.

The natural hardness of chromium gives it real value in resistance to abrasion, but chromium-plated articles are not protected by the plating from impact, since these distortions are a function not of the chromium coating, but of the hardness and resistance to distortion of the base metal upon which the chromium is deposited. The establishment of this fact eliminated a host of misapplications of chromium-plating.

Satisfactory chromium-plating is not especially difficult to do nor to any degree impossible or uncommercial. The control required for good chromium-plating is similar to the control required when good deposits of any of the other metals are secured. As you all know, unlike most electro-depositions, chromium is not obtained through the disintegration of metallic chromium anodes, but through the reduction by electrolysis of chromic acid. The amount of chromic acid annually consumed in chromium-plating plants indicates that during the past year more than 500 tons of chromium was electro-deposited.

Electro-Deposited Zinc

Zinc as an electro-deposited coating is especially interesting because zinc is the most widely used protective coating for iron and steel. The growth of zinc-plating is interesting also because, unlike copper, nickel, or chromium-plating it represents not a new coating for iron and

steel, but a new method of coating iron and steel with zinc, superseding the hot-dip process in many fields, and opening up new uses of zinc coatings as well.

Electro-deposited zinc in some applications is superior to hot-galvanizing. For example, the electro-galvanized steel wire has superseded, to a large extent, the hot-galvanized product. So-called rustless fly-screen wire cloth, which is electro-plated with zinc after the cloth itself has been woven on looms, is a good example of a product which it is practical only to produce by zinc-plating. Such other things as automobile rims, electric conduit pipe and fittings, sheets, bolts, nuts, nails, strip steel, chain, stampings, and miscellaneous hardware are now almost invariably coated with zinc by electro-galvanizing.

Zinc coatings, as you know, protect iron and steel from corrosion by sacrificing their own life to the protection of the base metal. Zinc as a rust protection therefore behaves differently from such metals as copper and nickel when so used. The useful life of a zinc coating as a protection against corrosion is therefore a function of the thickness of the coating in addition to its freedom from pits and pores. The quantity of zinc annually used in zinc-plating is certainly more than 10,000 tons.

Growth of Cadmium-Plating

Neglecting the rapid and spectacular rise of chromium-plating, as already pointed out, cadmium can be called the wonder metal of electro-deposition from the standpoint of rapid growth. Cadmium behaves like zinc as a rust-proof coating for iron and steel. Tests indicate that thinner coatings of cadmium than zinc are required to produce an equivalent rust-proof protection. The choice between cadmium and zinc coatings depends upon a number of factors, the most important of which, of course, is that of relative costs of the finished products when coated to an equivalent protective value with one or the other of these metals.

Cadmium is now being used in electro-deposition at approximately a rate of 650 tons per year and this 650 tons represents, as nearly as can be determined, a growth of some 1,000 per cent in four years. The growth of the use of cadmium has led, as has been stated, to a shortage of supply, the price of the metal as a result has more than doubled and cadmium is regularly sold in today's market to a large number of users at more than a dollar a pound.

Lead-plating has never been used extensively. Its field of useful application as an electro-deposit coating is small and yet there always will be this small outlet for lead in the form of deposited coatings. The deposit of lead is very dense and its protective value is considerable.

Tin-plating has been growing rapidly in recent years as a coating on the icing coils of mechanical refrigerators. These coils are electro-plated after assembly as a final finish. Furthermore, should the threatened shortage of the world's supply of tin become a reality, then tin-plating will be more widely used on account of the fact that very thin coats of tin give all the protection generally needed for tinned surfaces and these very thin coatings of tin can best be electro-deposited to be controlled precisely with respect to their thickness—something that is not nearly so practical when hot tinning is used.

Cobalt was advocatel some years ago in place of nickel. The cost of the deposition and its lack of real advantages as compared with nickel has thus far eliminated cobalt as a commercially used electro-plated coating. Nevertheless, cobalt can be electro-deposited and this field remains open as an outlet for it whenever the economics of the metals markets justify cobalt-plating.

Iron is used as an electro-deposited coating in a limited field for rebuilding worn parts and reinforcing some others. The cheapness of things made of iron or steel naturally curtails the range within which iron-plating is economical.

Brass-plating is widely used for protective and decorative purposes on steel-base hardware. The electro-deposition of brass is interesting because it represents the simultaneous deposition of two different metals, copper and zinc. Furthermore, by means of relatively easy chemical and electrical control, the percentage of both the copper and zinc to total metal deposited can be kept constant so that the brass color itself can be maintained at any given shade. It is obvious that so-called bronze-plating is merely a bronze-colored brass deposit.

In describing one of the uses of nickel not familiar to the general public, engravers' plates composed of electro-deposited thin layers of nickel and copper were mentioned. Such deposits we might call compound deposits and compound deposits can be readily produced by electro-deposition. They are frequently used in the rust-proofing of iron and steel; generally being deposits of nickel, copper, and nickel, or nickel, copper, nickel, and chromium. A deposit of nickel with a final coating of tin is one of the newer developments in what we may term metallic rust-proofs.

Precious Metal-Plating

The precious metal coatings, of course, suggest ornament and, as previously stated, these electro-deposited coatings suggest imitation. Both these ideas are inaccurate when considered apart from the rest of the facts. Unquestionably, a gold-plated article is valuable primarily for its ornamental effect and yet the resistance of gold to the action of acids enables us, through gold-plating, to produce an article of required mechanical strength with a coating simultaneously useful and ornamental. Gold-plated wire has been used in electrical apparatus to take advantage of this protective value of gold where it is doubtful if solid gold wire, even regardless of its cost, would have answered the purpose.

Many silver-plated articles are superior for the same reason to a solid silver article. And as an example, the automobile lamp reflector can be cited. Striking color effects can be obtained by precious metal combinations; for example, gold-plating on silver, and interesting and novel effects have been obtained with electro-deposited coatings of tantalum.

Naturally, when judged by weight, only small amounts of precious metals find a market outlet through the channel of electro-plating, but the money value involved is considerable. It is a fact that a single concern annually uses more than $400,000 worth of gold for electro-plating and that 17 per cent of the silver annually sold for industrial uses finds its way to the consumer on silver-plated ware.

So much has been said on the subject of electro-plating of metals that it seems fair to mention that non-metallic substances are also now coming within the scope of electro-deposition. Rubber, in the form of collodal latex, is now deposited on metal surfaces either as an adherent coating or as an electrolytic moulding. This achievement opens a vast new field to coating and fabrication.

Commercial electro-plating in the United States has advanced in the last dozen years from the control of the skilled foreman to the supervision of the plant chemist. A further step forward is in the offing. Chemists have already developed the fact that the crystal structure of the metal underneath is more or less reproduced in the electro-plated coating. Consequently both the bond between the base metal and its subsequent overlay and the continuity of the electro-plate itself is influenced by the surface crystal structure of the base. The metallurgist, therefore, has a direct interest in electro-plating developments and his aid will produce metal surfaces and characteristics to meet the needs of the electro-plater.

Brass and Nickel Plating

Q.—I would like to have a formula for a brass plating solution which would be strong enough to plate iron castings such as used on floor lamps. The solution should put on a plate in about 15 minutes and the plate should be capable of being colored on sheepskin wheels. I have a 6 volt, 300 ampere generator. My tank will hold about ten lamp bases weighing about 6 pounds each.

I need also a nickel solution for producing heavy white deposits on grey iron or steel castings of the same type.

How often is it necessary to add metal to the solutions which are used quite regularly? What should the additions be?

Is caustic soda the same as caustic potash or stick caustic, which is used in silver solutions? What is the difference between sal ammoniac and ammonium chloride?

A.—Use the following formula for brass solution:

Copper cyanide	4 oz.
Zinc cyanide	1 oz.
Sodium cyanide	6 oz.
Ammonium chloride	½ oz.
Water	1 gallon

Use this solution at a temperature of 80° F., with a cathode current density of 2.5 amperes per square foot.

If you use arsenic as a brightener, use a very small quantity,—⅕ of an ounce of arsenic dissolved in 1 ounce of caustic soda. A deposit of ½ hour should be sufficient. We would not recommend less.

Formula for nickel solution:

Double nickel salts	10 oz.
Single nickel salts	5 oz.
Boric acid	2 oz.
Sodium chloride	2 oz.
Water	1 gallon

Temperature 80° F.

Cathode current density, 10 amperes per square foot.

pH, 5.8.

A deposit of ½ hour should be sufficient.

Sal ammoniac and ammonium chloride are the same chemical. Caustic soda and caustic potash are different chemicals.

—Oliver J. Sizelove.

Nickel Plating Practice

Q.—We would like to know if black iron pipe used for heating coil in a plating solution will hurt anything if it is not in the circuit? Will a yellowish scum on the anodes hurt anything? There is a yellow sludge in the bottom of the tank which, when stirred up, leaves a yellow deposit on the work. I have a device to remove this sludge from the solution. I believe it will work mechanically, but will a bronze injector used in it harm the solution? The reason for asking these questions is that the parts plated in this solution come out dull. The solution is operated at about one hundred degrees Fahrenheit.

We are sending you under separate cover a sample of the solution for analysis. It is used in a rotary plating machine. The work that is plated is all steel.

A.—It is not advisable to use an iron pipe for a steam coil in a nickel solution. Better use a lead coil. The yellow sediment that you notice on the anodes and on the bottom of the tank is an oxide of iron. When present in large quantities this will cause a rough deposit if the solution is disturbed as would be the case with a rotary plater.

We can see no objection to the use of your device for filtering the solution if you have success with it. There are good filtering devices on the market. We wonder if one of them might not be superior to yours? The dull deposit may be caused not by the sediment that is in the solution but by the condition of the solution chemically.

—Oliver J. Sizelove.

Brush Silver and Black on Steel

Q.—Please give me a good formula for a solution to produce a brush silver finish. I would also like to have a good silver strike solution for use on brass and nickel silver. How much silver deposit is required for brass powder puff boxes? How can I determine the amount of silver deposited on the goods? Does it make any difference whether the articles are made of brass or nickel silver? How about the cleaning? What cleaners would you suggest and where can they be purchased? Is it necessary to have dips or electro-cleaners? Give me any other information for producing a good brush silver finish.

How can I produce a black finish on steel? I want to avoid copper plating the steel first.

A.—Formula for silver solution:

Silver cyanide	3⅛ oz.
Sodium cyanide	4⅛ oz.
Ammonium chloride	½ oz.
Water	1 gallon

You can use this solution to produce the brush silver finish or other finisher.

Formula for silver strike:

Silver cyanide	½ oz.
Sodium cyanide	10 oz.
Water	1 gallon

This strike can be used on brass or nickel silver.

The amount of silver to deposit upon your class of work varies with the finish desired. From 20 to 50 dwt. per gross is usual. We suggest that you purchase a Sangamo meter to measure the exact amount of silver deposited.

It does not make any difference, as far as the plating is concerned, whether the articles are made of brass or nickel silver. A little more care is required to clean the nickel silver than the brass. You can purchase your cleaners through advertisers of Brass World and the cleaners may be used either for immersion or electric cleaner.

To produce a first class finish, the work should be first polished, then plated. The brush finish is then produced by the use of pumice and water on a tampico or nickel silver scratch brush wheel.

The size of your tank to plate the work will vary with the amount of silver deposited. In a still solution of the formula given it takes about one hour to deposit 50 dwt. of silver on 2 gross of the articles mentioned, with a cathode current density of 5 amperes per square foot. The anode surface should slightly exceed the cathode surface. With a conveyor tank the cathode current density can be increased 50%, thereby reducing time to deposit the same amount of silver.

We suggest that you use a black nickel solution to produce a black finish on your steel work. Black nickel formula:

Double nickel salts	8 oz.
Zinc sulphate	1 oz.
Sodium sulphocyanide	2 oz.
Water	1 gallon

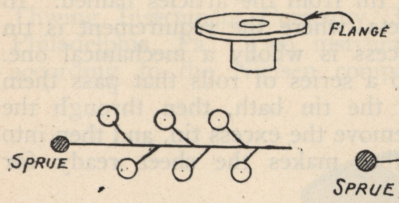
Use at room temperature with ¾ to 1 volt current.

—Oliver J. Sizelove

Molding a Brass Casting to Eliminate Pitting

THE foundrymen of a concern in the middle west recently were confronted with the problem of eliminating pits from brass flange castings which were made as shown in Figure 1. The flat flanges were cut from castings such as shown.

These castings had been molded with the flange side up and also with the flange side down. Two different



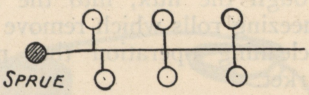


Fig. 1. (Upper)—Flange Casting. Fig. 2. (Lower)—Two Methods of Molding That Proved Unsuitable

gating arrangements were made, as shown in Figure 2. However, none of these efforts succeeded in eliminating the pits from the flange surface. Such considerations as gas generated from the sand or in the melting process were taken into consideration.

The problem was finally solved by molding the flanges face down and pouring the brass at 2100° Fahrenheit. The metal consisted of

Copper	82
Lead	4
Tin	4
Zinc	10

In making a gate for the mold, a piece of 3/16 inch

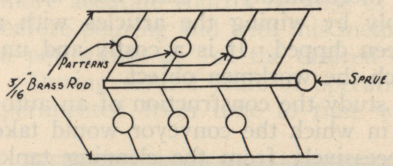


Fig. 3.—The Mold Gating Method That Was Finally Used

brass rod was soldered together as per the sketch in Figure 3, which permitted the gases to escape. It was found that there was no necessity of venting the mold, as had been suggested by one expert.

Resistance of Chromium to Weather

Q.—We have been using our chromium solution for three months and like it, due to its covering power and also its luster, but are at a loss as to whether or not it is sufficient for outside weather conditions such as we have in the middle west.

We are using between three and one-half and four volts and plating from three to five minutes in the chrome. The brass pieces are polished, buffed, and put through an electric cyanide cleaner after which they are nickel plated and colored. Then they are chromed as stated above, and sometimes they will require buffing but in most cases come out bright.

Die cast pieces are copper plated and nickeled before they are chromed.

We would like to know if this is sufficient coverage of chrome to withstand outside weather conditions.

We would like to have a good formula for a chromium solution.

A.—In placing upon the market brass work that has been nickel plated, nickel colored and then chrome plated, we believe that you have a finish that will withstand weather conditions for quite some time, providing the solutions are in proper working condition. The writer had the different parts of his car plated with nickel and chromium 2½ years ago and the brass parts are as good today as when finished, but the die cast parts that are exposed to the weather have failed.

Weather conditions in the eastern states are undoubtedly a more severe test on chrome plate than those of the central states.

In the work that has been done on chromium plating at the United States Bureau of Standards by H. F. Farber, it has been found that better throwing power is had by reducing the sulphate content and increasing the chromic acid content, although the efficiency of the bath may be lowered.

Formula for chromium solution:

Chromic acid	53 oz.
Sulphuric acid	.27 oz.
Water	1 gallon

Temperature, 104° F., 56 amperes per square foot.

—OLIVER J. SIZELOVE.

Chromium to Resist Citric Acid

Q.—We are confronted with a problem in regard to the feasibility of chromium plating iron for resisting the chemical action of citric acid.

What we are particularly interested in is whether a thickness of one-thousandth of an inch of chromium directly on iron would present a pit-holed surface through which the citric acid could attack the iron. Also, we are interested in whether or not there is any chemical action of the citric acid on the chromium.

Would a copper, nickel, chrome finish be necessary to protect the citric acid from any contamination?

A.—Time only could tell how successfully a deposit of chromium would protect iron from being attacked by citric acid. Chemically, citric acid would not attack the chromium deposit. If chromium failed it would be entirely due to porosity of deposit. For that reason we do not advise the deposition of chromium directly over the steel as it is almost sure to be porous. We advise the following: ½ hour deposit of nickel; ½ hour deposit of copper; 1 hour deposit of nickel; and then chromium one-thousandth of an inch thick.

Such a cycle, we are confident, would prevent any of the citric acid reaching the steel.

—JOSEPH HAAS.

Mechanical Hot Tinning

Q.—In the July issue of BRASS WORLD, we read a very interesting article on "A Comparison Between Metal Coating Processes" by Dr. James Silberstein. This article is of special interest to us as we use a lot of tinned parts in the articles we manufacture in our plant in France.

For tinning we use the hot dipping process and we tin such articles as copper sheets, cast brass parts, ends of copper tubes tinned inside and outside.

We think there must be a great similarity between galvanizing and tinning, and we were interested to read in the above mentioned article, that "on leaving the bath, excess zinc is removed mechanically." Until now we removed excess tin simply by wiping the articles with a cloth after they had been dipped. It is a costly and unhealthy process to which the workmen object.

We have now under study the construction of an automatic hot tinning unit in which the conveyor would take the different parts successively from the cleaning tanks to the hot tin dipping tank, thence to a heated room where the articles would be allowed to drip in order to remove the excess tin.

From the description of this process, you can understand that we would very much like to know what are the mechanical means used in the galvanizing industry to remove the excess zinc. No doubt we can gain some interesting ideas which could be used advantageously in our process.

We also would value very much any suggestion you may give us as to the best method of tinning in the line of the process we have explained above.

A.—We have no knowledge of any mechanical means of removing the excess tin from the articles named. In the case of "iron" sheets, where the requirement is tin on both sides, the process is wholly a mechanical one. The sheets are fed into a series of rolls that pass them through the flux, into the tin bath, then through the squeezing rolls which remove the excess tin, and then into a cleaning operation that makes the sheet ready for market.

Copper sheets, where the demand is mostly for sheets tinned on one side, are tinned and wiped with tow swabs by hand.

The Aetna Standard Engineering Company of Warren, Ohio, specializes in manufacturing tinning machinery, and we would suggest submitting your problem to them.

—WILLIAM J. PETTIS.

Copper Plate on Glass

Q. We are sending you sample of metalized or copper plated glass.

We are interested in knowing what medium having conductive qualities was used in this sample.

A. The copper plated glass you submitted as a sample was made as follows:

First, sand-blast then scrub with warm soda ash solution; rinse off with warm water; pour 2% hydrofluoric acid solution over glass surface to be plated and scrub with brush. **Rubber gloves should be worn and care should be taken not to splash the acid in the eyes. Hydrofluoric acid gives very bad burns.** Rinse off thoroughly with warm water.

SILVER SOLUTION; Make Solution No. 1 by dissolving in 12 oz. distilled water 12 grains of Rochelle salts and 16 grains of silver nitrate. Filter and place in a dark bottle. Make Solution No. 2 by dissolving 1 oz. silver nitrate in 10 oz. distilled water. Slowly add liquid ammonia until a brown precipitate first formed is nearly but not entirely dissolved. Make up to 12 oz., filter, and place in a dark bottle.

PROCEDURE: Take the cleaned glass plate and place upon a perfectly horizontal table; block up the plate so as to give it a 1 inch incline in 40 inches. The plate is wetted first with a Rochelle salt solution (1 part Rochelle salts in 200 parts water). Then mix solutions No. 1 and No. 2 in equal parts and pour slowly on the plate so that it runs down the incline. When the solution has run down the incline, the plate is let down to a perfectly horizontal position and heat is turned on under the table which should have a series of coils to produce a temperature of 68 to 72° F. After 20 minutes, sufficient silver will be deposited. The mixture is then poured off the plate, the plate rinsed off with a stream of warm water, and the deposit allowed to dry.

After drying, the plate is placed on a suitable rack with wire contacts, rinsed in denatured alcohol, and transferred to an acid copper solution to be copper plated. The acid copper solution is made up of copper sulphate 20 oz., sulphuric acid 8 fluid oz., water 1 gallon.

The glass is plated in this solution with at first not more than ½ volt. When the entire surface is coated with copper, after about 1 hour, plate at 1 volt and you will have a deposit of copper as upon your sample in about 8 hours.

—JOSEPH HAAS.

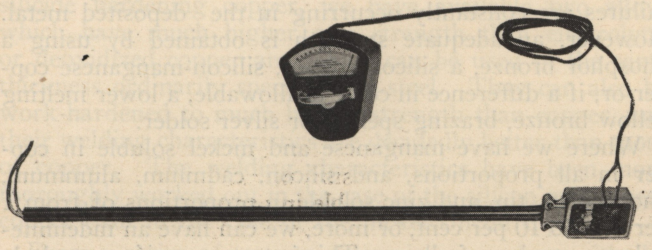
Flexible Copper Water Pipe

The introduction to the plumbing and other industries of a distinctly new type of water tubing is announced by the Chase Companies, Inc., Waterbury, Conn. This material is a flexible tubing for which extraordinary qualities of strength and flexibility are claimed. Referring to the product as a new departure in plumbing material, the makers state that its installation is cheaper and easier than replacement by standard brass or iron piping. Being flexible, it can easily be served around most corners without elbows or couplings. In some cases 60-foot lengths may be used in continuous pieces. It is stated that the new type of tubing will stand up under 3,000 pounds pressure. All necessary fittings for connecting the lengths with standard faucets, hot water tanks and standard water pipe are also being manufactured by the Chase concern. The company is also making copper straps for fastening down the tubing. The tubing and fittings are made in sizes from ⅜ to 2 inch.

The only tool in addition to ordinary plumbing tools required to handle the pipe is a special flanging tool which is also supplied by the company. Rodney Chase, vice-president of the Chase Companies, is understood to be largely responsible for the development and introduction of the pipe.

Survey of Pyrometer Operation in Non-Ferrous Foundry

The operation of pyrometers used in connection with the foundry work of the Ellison Bronze Company, Jamestown, N. Y., hardware and ornamental bronze manufacturers, is the subject of a survey by the A. C. Nielsen Company, Chicago, Ill., an abstract of which is given below. The Nielsen engineers studied the Thwing pyrometers in the Ellison plant with a view to determining the actual cost of such operation and its effect upon the production. The pyrometers are the product of the Thwing Instrument Company, 3339 Lancaster Avenue, Philadelphia, Pa. Two instruments were studied and, according to the Nielsen company, it was determined



Complete Pyrometer Outfit of the Type That Was Surveyed

that definite operating economies were effected by the precision methods entailing their use.

The Ellison company has used Thwing pyrometers for twelve years, it is stated, checking from 25 to 40 pots of metal daily, with from 2 to 12 readings obtained per junction. The use of the instruments permitted pouring within 25 degrees of the desired temperature. The first instrument was operated for twelve years with only one repair. Both pyrometers are calibrated monthly. It was found that the annual operating cost is $37.85 per instrument and the daily cost $0.13 per instrument. Closer control of temperature is stated to have effected a 5% decrease in rejections and since rejected parts cause an average loss of 20 cents per pound, the company has saved $19.74 a day while using the pyrometers, an annual gain of $5,922.

The method of testing temperatures at the Ellison foundry is described by the Neilsen company as follows.

The products of the foundry call for both deep mold and shallow relief work and castings range in weight from a few ounces to several hundred pounds in the case of bank fittings, large plaques or ornamental pieces. The foundry operates 10 hours a day for 300 days a year. Metal is melted in 3 reverberatory furnaces. From 5 to 7 heats per furnace are poured daily and the total output averages 2,000 lb. of castings. Fuel oil is used. Metal to be cast is taken from the furnaces in 100-lb. pots, and each pot is tested for pouring temperature as it is carried to the foundry floor about 50 feet away.

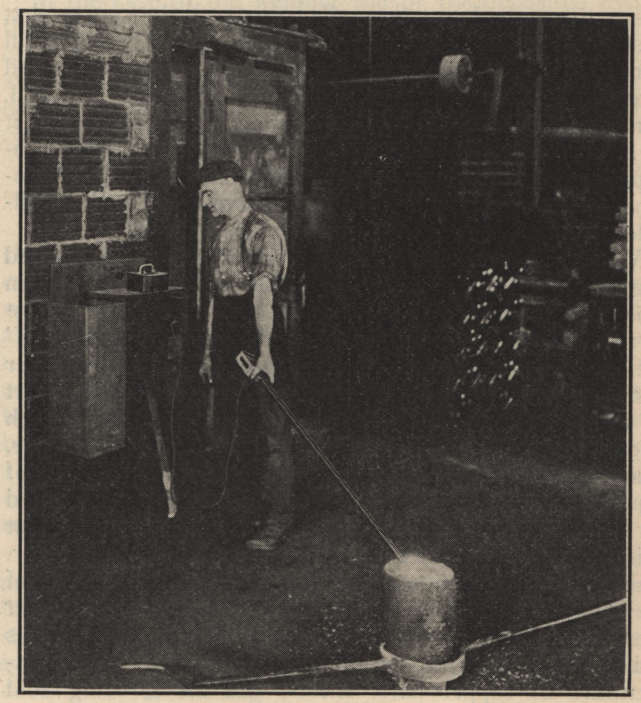
The two pyrometers are mounted on a small waist-high shelf on the passageway from furnace to floor. Although sturdily constructed they are protected by a cover when not in use. The arms containing the thermo-couple wires are also in a box on the shelf and can be quickly removed when needed, thus protecting the instruments from careless handling.

Readings are taken immediately after fluxing by one of the men carrying the pot or by the foundry foreman. The charcoal on the surface minimizes adherence to the junctions so that with brass or bronze two or three readings are taken with one junction and with aluminum ten to twelve readings. Two junctions can be made before pulling additional wire from the spools.

The maximum time required to take a reading (setting the crucible down, immersing the elements, reading the instrument, skimming, etc.) is 30 seconds, although the elements are actually immersed only 7 or 8 seconds in brass and slightly longer in aluminum. Use of two instruments permits testing two metals being poured, without having to change junctions. Aluminum is poured at about 1300° F., yellow brass and phosphor-bronze at 2100 and commercial bronze at 2150°. If a pot is too hot it is stirred to hasten cooling and if too cold it is returned to the furnace.

Testing pot instead of furnace temperatures permits more accurate control because of the brief lapse of time before pouring and with this method it is possible to pour a pot within 25° of the desired temperature.

During several years of operation this foundry has experimented from time to time with allowing either the



Taking Temperature of a Pot of Molten Metal

foreman or a laborer to judge temperatures by eye and to pour when the color appeared right. In each case such practice resulted in improper pouring temperatures, and rejections of castings increased from the normal 2% or less to as high as 10% because of frequent mis-runs due to cold metal, or to porous castings resulting from too high a pouring temperature. The latter is particularly expensive since often the defects are not discovered until considerable finishing work has been done on the parts. The metal is recovered but the cost of the finishing operations up to the point of rejection represents a loss.

Trade Mark on Green Thread Buffs

E. Reed Burns Manufacturing Corporation, 21 Jackson Street, Brooklyn, N. Y., manufacturers of buffing and polishing materials, has obtained trade mark registration at the United States Patent Office on its official mark for "Green Thread Buffs." This trade mark has been used on labels and other markings for the company's buff wheels in Class 4, abrasive, detergent and polishing materials, continuously since October, 1928.

Copper and High Copper Alloy Welding

Practical Data on a Subject of Increasing Importance to the Non-Ferrous Metal Industries—Results of Tests

By IRA T. HOOK
American Brass Company, Waterbury, Conn.

ABSTRACTS OF A PAPER READ AT FALL MEETING OF AMERICAN WELDING SOCIETY, CLEVELAND, OHIO, SEPTEMBER, 1929

WHILE there has been an increasing demand for copper and copper alloys because of their well known qualities of beauty and utility, there has been comparatively little written on the welding of them. Not considering the question of first cost, the reason for the lack of data on copper and copper-alloy welding is probably because, in the first place, copper, with its extraordinary high heat conductivity, offers inherent difficulties to the welder and he is prone to seek other metals easier to manipulate. Secondly, nearly all the copper that is sold as such is electrolytic or Lake copper carrying small percentages of cuprous oxide, which cuts down the welded strength to 50 per cent of that of the dead soft material. Finally, pure copper has but a modest strength, and it is only within the past three or four years that high-copper alloys with excellent welding characteristics, combined with equally good strength, have been made available.

While copper resists atmospheric oxidation to a marked degree, it will take up considerable amounts of oxygen when in the molten state. In the copper refineries, most of this oxygen is removed during the process of "poling" the molten copper in the reverberatory furnace. Copper cast from such a furnace constitutes by far the larger part of the copper of the industries. It is known as "tough pitch" copper, or more frequently as electrolytic copper. The small amount of oxygen in the copper in the form of cuprous oxide is beneficial when the copper is to be used for electrical purposes, cold worked, or cast into shape, but it is quite detrimental from the standpoint of the welder. The welder either must allow for the weakening effect of the cuprous oxide by a suitable increase in the contact area or he must use an oxygen-free copper. The latter is available as a standard product of nearly all of the manufacturers of copper bars, sheets, and tubes, being sold under the general name "Deoxidized copper."

Cuprous Oxide Content

Another property which offers even greater difficulty to the welder than the content of cuprous oxide, is the high rate at which heat will flow through copper. There is no easy way to overcome this handicap in welding. Precautions can be taken to conserve the heat in the metal by covering the surface with asbestos, but a larger input of heat must be used than is the case with steel or cast iron. Also, owing to the extremely rapid transfer of heat through the copper, it is necessary to have the metal back from the weld at a much higher temperature than it must be with the ferrous metals. A preheating is often necessary to fulfill this condition.

The difficulty encountered in securing a strong bond with electrolytic copper points to the use of an oxygen-free copper. This can be obtained readily by remelting the electrolytic copper and adding a deoxidizer in amounts sufficient to react with all of the oxygen. For most purposes, an excess of the deoxidizer does no harm and is decidedly beneficial to the welder, but where the electrical conductivity is a requirement, extreme care must be exercised.

A great deal of time and effort has been wasted in trying to overcome the difficulties encountered in the welding of copper by the use of various alloys. It is desirable, of course, for the welder to use a welding rod stronger than the base metal. It is a reflection on his judgment if failures are constantly occurring in the deposited metal. However, an adequate strength is obtained by using a phosphor bronze, a silicon copper, silicon-manganese copper or, if a difference in color is allowable, a lower melting yellow bronze, brazing spelter, or silver solder.

Where we have manganese and nickel soluble in copper in all proportions, and silicon, cadmium, aluminum, phosphorus, tin, and zinc soluble in proportions of from 1 per cent to 10 per cent, or more, we can have an indefinitely large number of alloys. This is true, even if we exclude the tin and zinc and restrict the alloying metals to a maximum of 4 per cent.

Welding Tests

Results of welding tests made up to the present time do not represent the maximum values that can be obtained with any one method of welding, since the man making the welds could not be kept on any one method long enough to develop a technique which would give maximum results. The results, however, do show quite conclusively several things:

1. It is practicable to weld electrolytic copper with the oxy-acetylene torch, the carbon arc, or the metal arc. With the latter method, a certain amount of preheating is necessary to start the weld.
2. Provision must be made by way of increasing the contact area in order to develop the full strength of the base metal. This can be done with the "Shear V," the "wide angle," or the reinforced weld.
3. A resistance butt weld seems to develop nearly full strength. The cuprous oxide is distributed so finely as to lower the strength from that of dead soft copper only slightly.
4. Following the general principle that the best of two satisfactory welds is that one made with the least heat, we would select the Tobin or manganese bronze rods first, wherever it was permissible to use a high-zinc mixture. Where it is necessary to use the arc, the yellow bronzes are unsatisfactory and the silicon-manganese copper seems to offer the best characteristics for a welding rod.
5. Though the tensile tests do not disclose the correct value of the welding method in making sound welds, the writer watched these tests very closely and is convinced that the use of the oxy-acetylene torch and the carbon arc are much more reliable in producing welds free of blowholes than is the metal arc.

Deoxidized Copper

As with the electrolytic copper, results on deoxidized copper are not the maximum results possible, but are sufficiently representative to enable us to draw definite conclusions, thus:

1. The phosphorus deoxidized, the silicon deoxidized,

and the silico-manganese deoxidized coppers are all welded with nearly equal facility.

2. With a given welding rod, the full strength of the deoxidized copper can be developed without resorting to a reinforcing bead.

3. The highest strength of joint is developed using a high-zinc yellow bronze. With this welding rod, the base metal need not be fused. The 3 per cent Si, 1 per cent Mn, remainder Cu, welding rod can also be applied without fusion of the base metal.

4. The oxy-acetylene torch and the carbon arc both give good welds. The metal arc is possible but the resulting welds are more porous than with the first named methods and a certain amount of initial preheating is necessary.

With the advent of the silico-manganese copper and silicide hardening copper, we have available two alloys which have much higher cast strength than electrolytic or deoxidized copper and which can be used in the same thickness ordinarily specified for steel. They can also be work-hardened to much higher strength than copper, and their welding characteristics are decidedly better than those of copper. The welding characteristics have been more thoroughly worked out in the case of the silicon manganese copper than in the case of the nickel silicon copper.

From a series of tests to determine procedure with the oxy-acetylene welding torch, it seems safe to conclude that the oxidizing flame is the economical one to use. The reason for this is that we get a much greater concentration of heat than with the neutral flame, while at the same time the excess oxygen does no harm as it would with steel or bronze. The molten metal is protected by a thin coating of silica glass which spreads evenly over the metal in an impervious layer. As the metal cools and shrinks, a high compressive stress is put in this thin blanket of silicon and it flakes off with some violence, leaving a smooth-surfaced head.

To the welder familiar with the flowing properties of low-carbon steel, this silicon-manganese copper would seem to flow marvelously free. Under the torch or the arc, it flows like water, and will lie quiet under its protecting sheet of silica even in the full blaze of the electric arc. It has, however, one weakness which must be guarded against—it is hot short in the recrystallizing-temperature range just below its melting point. Thus, as the metal cools down from the molten to the solid state, precautions must be taken to avoid tensile stresses. Also, since selective freezing is a function of time, we should hasten the cooling through this range as much as possible. The advantage of a high concentration of heat over as small an area as possible is at once apparent. The same precautions should be taken in the welding of the nickel-silicon copper alloy. For a similar reason the seam should be completely welded in one pass. A second pass is followed by a track and the weld is worthless. If it be necessary to go over a seam the second time, it can be accomplished without danger by preheating the sheet on either side of the seam just ahead of the electrode.

In oxy-acetylene welding of steel with silicon-manganese copper rod, unless precautions are taken to break up the silicate coating between the added metal and the steel base, the bond will be of low strength and the added metal will fail in adherence to the steel. Where the added metal is deposited quickly, however, as with the metal arc or on thin sheet steel with the oxy-acetylene torch, an excellent strength is obtained.

Workable Procedure Control

A workable procedure control is necessary to insure sound welds, and this scheme involves a careful supervision of the four indispensable features: men, materials, methods, and inspection. It is a difficult matter to lay down an accurate procedure control that will apply equally well to a plumbing concern which is interested principally in welding pipe; a sheet metal shop using 14- to 26-ounce metal, a boiler shop using thicker and heavier sheet, or a foundry specializing in castings. However, there are general principles, as follows:

MEN. Expert welders are essential to the successful welding of high-copper alloys. To be expert with the copper alloys, the welder should be experienced with the oxy-acetylene torch, the metal arc, and the carbon arc. He should know what method to use on a given job and what flux to use, as well as what welding rod to use and how to use it.

MATERIALS. The base materials are usually determined on the basis of cost, desirability on account of its physical or electrical properties, and similar factors, and neither the welder nor the welding supervisor has much to say about it.

In the case of the welding rod or the deposited metal, the welder should have more to say. He should, in the case of the high-copper alloys, use a rod that will weld avidly with the base metal at the lowest heat to yield the desired strength and resist corrosion or change under the conditions that the assembly is to be used.

The welding rods which are most appropriate for high-copper alloy base metals are as follows:

1. HIGH-STRENGTH YELLOW BRONZES. This class includes Tobin Bronze, manganese bronze, and similar compositions sold under various trade names. These welding rods melt at the lowest temperature of any rods above the silver solder class. In no case is it necessary to fuse the base metal. These rods should be given first consideration as they have a higher strength than the base metal and use a lower amount of heat. They would be ruled out: (a) where the electric arc is to be used, (b) where the difference in color is objectionable, and (c) where exposed to an open flame or immersed in acid solutions, and used with a high-copper base metal.

2. DEOXIDIZED COPPER. These rods can be used with any method of welding. A fusion weld is the result, having the strength of dead soft copper only. The rod should carry sufficient deoxidizer to react with the oxygen during the deposition. Silicon is the best all-around deoxidizer for welding.

3. HARDENED COPPER. The writer is in favor of adding more of the deoxidizer as an alloying element and obtaining thereby thorough deoxidization, greater strength, lower melting point, and better welding characteristics generally. For this purpose the alloy carrying 3 per cent silicon, 1 per cent manganese, and 96 per cent copper is recommended, but as is shown in the foregoing, other similar alloys can be employed.

METHODS. Little can be said concerning the proper welding procedure except as it applies to a particular job.

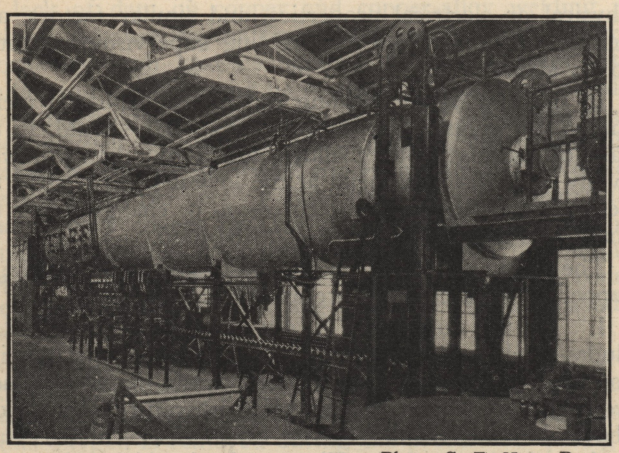
INSPECTION. All types of welds should be tested periodically.

Co-operative Plant Equipment Show

The Co-operative Exhibition of the Salesmen's and Purchasing Agents' Association of America, held October 17 to 19 at Bridgeport, Conn., displayed exhibits of many well known lines of plating and polishing equipment and supplies. Practically all the firms handling these lines in New England were represented at the exposition, which featured small tools, direct and indirect materials and general factory supplies.

Electric Brazing in Hydrogen Atmosphere Furnace

The General Electric Company, Schenectady, N. Y., has developed a new type of furnace for brazing with copper flux in an atmosphere of hydrogen. The furnace is automatic in operation, the only labor involved being that necessary to keep the furnace supplied with work. The General Electric Company perfected the hydrogen atmosphere brazing method early in 1928, the company states, after many years of research work. The hydrogen atmosphere method of brazing, while not entirely new, was formerly attended by a number of practical difficulties in application. These have now been eliminated and the apparatus is being manufactured for the market. A view of a hydrogen brazing furnace is shown in the accompanying illustration.



Photo, G. E. News Bureau

Continuous Brazing Furnace Using Hydrogen Atmosphere

The new General Electric furnace is of the tunnel type of construction. The furnace proper rests on supports above a roller conveyor. On this conveyor rests a row of trays on which the work is loaded. The furnace itself has openings at either end, in the bottom. The furnace is heated at the entrance end and cooled at the other. Motor operated elevators, located beneath the furnace openings, raise the trays into or lower them from the furnace.

In operation, the trays are loaded on the roller conveyor which is completely covered with trays from end to end. The elevators, at the beginning of the cycle, are in the lower position. A motor-operated ram at one end then pushes the tray from the discharge elevator upon the conveyor, thus moving all the trays along and pushing one tray upon the intake elevator. The elevators then ascend automatically until the loaded elevator brings its work into the heated end of the furnace, while the empty elevator is ready to receive a tray of brazed work at the discharge end. Another motor-operated ram pushes the intake tray into the furnace and thus pushes out a tray of completed work upon the elevator at the other end. The furnace is equipped with a conveyor system similar to the one below it. The elevators now drop to the lower position once more and the cycle is repeated.

The heating units located at the entrance end of the furnace are arranged in several zones, the temperature of which is automatically controlled.

In loading the work on the trays, it is arranged on vertical supports. When in the heated end of the furnace the tray itself is carried in a lower chamber, the vertical supports projecing up through a slot and thus keeping the work in the heated portion of the furnace, while the tray is protected. As a further protection to the tray, it is covered with heat insulating material.

In preparing the work for brazing, the parts are either wound with copper wire or coated with copper paint. The effect of the gaseous atmosphere (a mixture of hydrogen and nitrogen) is that of a flux, cleaning the work and causing a very smooth flow of the liquid copper over the surface to be brazed, and into the joints.

Brown Oxidize on Brass and Steel

Q.—Will you please outline procedure for getting an oxidized brown finish on steel and brass articles, such as screws, etc.?

I have been experimenting with ammonia, tannic acid and muriatic acid, but have not obtained results as yet.

A.—Brown oxidize for brass screws:

Place screws in baskets and clean. Immerse in a warm solution of barium sulphide ½ oz., water 1 gallon, until the screws turn brown.

Brown oxide on steel screws:

Place screws in a wooden tumbling barrel. Pour on them the following solution:

Copper sulphate	4 oz.
Ferric chloride	2 oz.
Nitric acid	1 fluid oz.
Water	1 gallon

After tumbling about 10 minutes, pour solution off, remove screws into a basket, rinse in cold water, then in hot water, and then tumble in sawdust.

—Joseph Haas.

Chromium Plating Textbook

A new book on electroplating, with particular reference to chromium, will be issued early in November under the title "Electroplating with Chromium and Other Metals." The book, written by B. Freeman and F. G. Hoppe, is being published by Prentice-Hall, Inc., New York. It will sell at $5 and will be obtainable from Brass World.

The volume will cover in detail all the elements entering into successful chromium plating, covering the cleaning and pre-plating operations thoroughly, it is stated. Such subjects as overcoming flaws in nickel, chromium polishing methods, solutions for copper and other finishes. Types of racks for chromium work is an important part of the book.

Small Optical Pyrometer

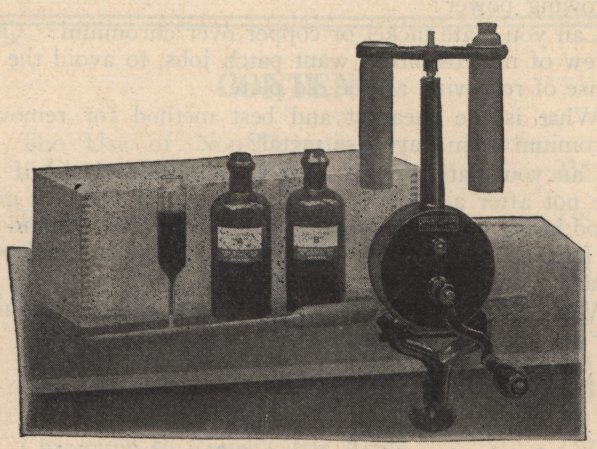
The Maco Template and Engineering Company, Ltd., 19 Cursitor Street, London, E. C. 4, England, has placed on the market an optical pyrometer of very small size for use of metallurgists, foundrymen, refiners, smelters and others who have need of a pocket pyrometer that is claimed to be accurate and durable. The instrument is known as the "Pyroversum" and can be carried in the pocket. It registers temperatures from 550° to 1200° Centigrade, has a scale 5½ in. long, calibrated for every 10 degrees. It weighs one-half pounds. The makers state that the instrument has received the highest recommendations from European users, including the British Government, the British Royal Mint, the London metropolitan water board and many firms. Its special features are listed by the Maco company as follows:

Prepared for instant use; no adjustments needed; no waiting for measurements; records from any distance; no skill necessary for operation; low initial cost and no renewals needed; accessories and dipping solutions eliminated; readings accurate; size and shape to suit pocket; uninfluenced by atmosphere changes.

Simple Sulphate Test Apparatus

The "Kocour" test set for determination of sulphate content of chromium plating solutions has been placed on the market by the State Manufacturing Company, 4724 South Turner Avenue, Chicago, Ill. The apparatus, as shown in the illustration, is sold together with the necessary chemicals for rapid and accurate testing, according to the makers, who give the following data in regard to its operation:

Using the small pipette, 5 ml of solution "A" is introduced into one of the centrifuge tubes. Using the large



New Sulphate Test Outfit

pipette 20 ml of the solution to be tested is added to it and the mixture shaken. Now 5 ml of solution "B" is added and the tube corked and shaken vigorously for one minute and then allowed to stand for 5 minutes. It is now placed in the centrifuge and centrifuged until the volume of the precipitate formed in the stem of the tube becomes constant. Usually this takes less than one minute. The stem of the tube is graduated so that each division represents .02 (two thousandths) of an ounce (avoirdupois) per gallon of sulphate. Major divisions on the stem each represent .1 ounce per gallon.

All tests that we have made with this apparatus check with the chemical methods to the nearest .02 oz./gal. and in most cases to the .01 oz./gal. These tests were made on a great variety of solutions and in no case was a discrepancy found, the makers claim.

The set includes: A well made centrifuge with head and shields, two calibrated centrifuge tubes, one 8 oz. bottle each of solutions "A" and "B", pipettes, and a card of directions. The only upkeep is the cost of replenishing solutions "A" and "B." Analyses of these solutions are given in a direction card for those wishing to make their own.

Forty tests can be made with the two bottles of solution. The direction card gives the detailed procedure to follow as well as methods of determining the amount of sulphate to add when such is needed. The entire outfit is packed in a slide top, lock corner box which can be screwed to a wall and used as a cabinet for the solutions and tubes.

Thermo-Element Repairing

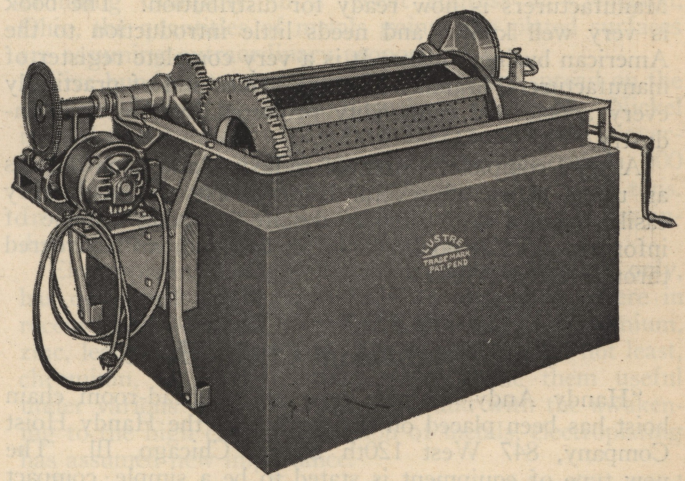
Charles Englehard, Inc., Chestnut street, Newark, N. J., offer a service of reclaiming used thermo-elements made of rare metals and alloys. The company states that upon examination under the microscope, used thermo-elements show a crystalline structure as well as discoloration.

These changes, they state, can be be reversed by a special reclaiming process and the thermo-element restored to operating condition. While a couple cannot always be restored to its original condition, they state, it can be sufficiently improved to make the service profitable to users of thermo-elements.

New Type Barrel Plating Machine

The Lustre Company, Inc., St. Louis, Mo., manufacturers of the "Lustre Vertical Motion Plater" and other equipment and supplied for electroplaters, has introduced a new type of cylinder plating machine for copper, brass, zinc, cadmium or nickel.

The machine, shown in the illustration, is said to have a number of features and advantages which distinguish it. Among these are the elimination of chains, cables, belts, and overhead obstructions; no mechanical gears in solution; all-formica cylinder of very rigid construction; gears always meshed; simple, easy lifting of cylinder regardless of load; automatic clutch permitting free swing-



Jacketed Cylinder Plater in Unloading Position

ing of cylinder in either direction for loading and unloading; jacketed tank to regulate temperature of solution.

It is pointed out by the manufacturer that the jacket feature makes it possible to eliminate all delays due to improper solution temperature. The apparatus can be used for copper, brass, cadmium, nickel or zinc plating. It can be furnished with wooden tank if desired, and extra heavy welded tanks are made for hot or cold cyanide solutions.

Chromium Plated Display Sheets

Chromium plated sheet metal for advertising and other uses is being offered by Apollo Metalarts, La Salle, Ill. The company manufactures the sheets in various thicknesses, with one side chromium plated.

The makers state the sheets have been adopted for window displays and other purposes by all types of stores and other businesses requiring brilliant, attention-compelling displays.

Its ultra modernity is stressed, as well as its adaptability to a great variety of uses. The company markets the material under the name "Chromflex." Copper, nickel and brass plated sheets are also available under the designations "Copperflex," "Nickelflex," and "Brassflex." These are also being used widely for display and advertising, according to the makers.

Rustproofing Steel Springs

Q.—I am sending you a sample of a steel spring which is to be used in an appliance to be worn around the body for therapeutic purposes. This spring, while not supposed to come in actual contact with the body, must be protected from corrosion. The spring is to be made in lengths from 11 to 16 inches. Can you tell me how a lead coating or some other protective coating would do to protect the springs?

A.—The flat steel strips that are placed in women's corsets are galvanized, and we are of the opinion that the strip of spring wire that you submit would also best be galvanized or zinc plated. Zinc will resist corrosion and a zinc solution will give you considerably less trouble than a lead solution.

—Joseph Haas.

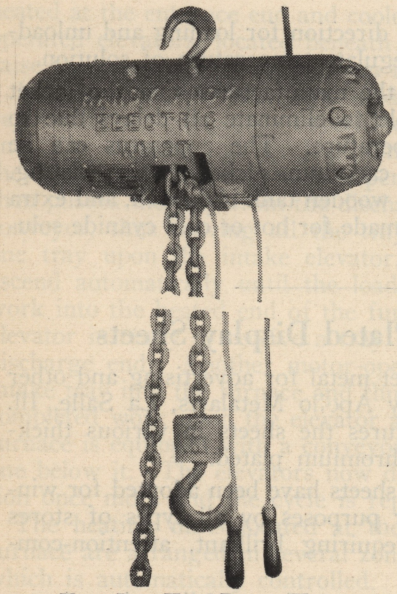
New Issue of Manufacturers Register

Thomas Publishing Company, New York City, announces that a new issue of Thomas' Register of American Manufacturers is now ready for distribution. The book is very well known and needs little introduction to the American business man. It is a very complete register of manufacturers, brands and trade names and of practically every article and commodity produced by American industry.

A very complete system of indexing and such devices as using paper of several colors make the book very easily handled and compact despite its great volume of information. The book is sold for $15 and can be ordered through Brass World.

Low-Head-Room Chain Hoist

"Handy Andy," a new type of low-head-room chain hoist has been placed on the market by the Handy Hoist Company, 847 West 120th Street, Chicago, Ill. The new type of equipment is stated to be a simple, compact hoist having a total weight of 160 pounds, 24 inches in length and 7½ inches in diameter with lifting capacities of 500, 1,000 and 1,500 pounds. It is a fully enclosed unit, all working mechanism being encased in a heavy cast housing, from which the entire gear mechanism, as well as the drum-type switch, may be easily taken out by removing the end plate. The motor can be removed without disturbing the wiring.



New Low-Head-Room Hoist

The hoist is equipped with 110 volt, universal A. C. or D. C. motor, with cord and plug for operation from any lamp socket. Standard equipment also includes 12 feet of load chain with hook at one end, and it has positive mechanical load control—brake engaging at the same time switch is thrown into neutral thereby preventing either coasting or slipping of the load.

Chromium Installation

Q.—I have a small plating shop for refinishing copper and nickel and am thinking of going into chromium and would like information. At first I am going to experiment with a 5 gallon tank until I find the solution best adapted to my equipment. My equipment consists of 1 tank (each 250 gallons) copper and nickel; generator, 6 volt, 300 amperes. Is the generator large enough for chromium?

What is the best solution for chromium plating with normal room temperature? I have no way of heating the solution. Also, what is the solution with the greatest throwing power?

Can you plate nickel or copper over chromium? Quite a few of my costumers want patch jobs, to avoid the expense of removing all the old plate.

What is the cheapest and best method for removing chromium from any base metal?

Can you plate directly over iron, steel or brass if you are not after a good polished surface? I want to get a good heavy coat on iron, steel or brass that will stand lots of friction; polish is not necessary; all that is required is wearing quality.

What kind of tanks, anodes, current, etc., are required for the chromium solution?

A.—Formula for chromium solution:

Chromic acid	55 ozs.
Sulphuric acid	0.3 oz. by weight
Water	1 gallon

Temperature, 95° F. Cathode current density, 50 amperes per sq. ft. Use 6% antimony lead anodes.

As temperature control is one of the most important factors, you could place the solution in a glass lined iron tank and heat it with gas if you have no steam.

It is impossible to nickel or copper plate over a chromium deposit successfully. It is best to remove the chromium deposit in a hot muriatic acid solution, the stronger the acid the less time it will take to remove the chromium deposit.

You can deposit chromium directly upon iron, steel or brass, but it is not recommended to do so for your class of work. It is best to deposit nickel on the base metal and then chromium plate.

—Oliver J. Sizelove.

New Williamsville Buff Lines

Several new lines of buff wheels have been placed on the market by the Williamsville Buff Manufacturing Company, Danielson, Conn. In connection with the announcement of these added products, Fred W. Worch, vice-president and general manager of the company states that his company has been engaged in the manufacture of cotton buff wheels since 1893. The original product of the company was the A-1 buff wheel, which the company still manufactures. This is an 80x92 count, 3.25 weight and is made of Quinebaug sheeting. According to Mr. Worch, this was the first high-count buff to be universally adopted by the polishing trade. With changing industrial conditions the company has added to its line a 3.15 weight buff and also a 2.90 weight in 84x92 count, also made of Quinebaug sheeting and said to be of very high grade.

The company's business has steadily increased through the years, with the last two showing an especial gain in sales of the high quality wheels manufactured under the Williamsville trade mark, Mr. Worch states.

BRASS WORLD

And Plating — Polishing — Finishing

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How Metals Are Consumed in Electroplating

ELECTROPLATING, from its very inception, is less than 100 years old. In 1833, Michael Faraday discovered and stated the laws of electrolysis. Silverplating had its birth in Birmingham, England, in about 1844. Today we plate not only silver, but nickel, copper, lead, zinc, tin, cadmium, gold, and we are beginning to plate aluminium and cobalt. According to figures given by F. T. Taylor, vice-president of the Hanson-Van Winkle-Munning Company, in a recent address at Cleveland, Ohio, the quantities of metals going into plated surfaces are assuming extraordinary proportions.

Five hundred tons of copper per year are spread on the surface of work about .0001 inch in thickness. Nickel is used to the extent of 2,000 to 3,000 tons a year, covering an area about 25,000 acres in extent; chromium, 500 tons; zinc, over 10,000 tons; cadmium, about 650 tons. In the precious metals, 17 per cent of silver sold for industrial uses goes into silverplated ware.

Electroplating, originally used for appearance only, has developed another and fully as important sphere in recent years—that of a corrosion preventive. Cadmium, zinc, lead, nickel, brass and copper, and last but not least, chromium, all have qualities which make them useful under various corrosive conditions, and with the awakening to the high cost of corrosion of metals, electroplating has assumed new importance.

The increased standing of electroplating has interested the executives, operating and financial, to a much greater degree than ever before. The effect has been to bring plating departments under the same production regulations and systems as other manufacturing departments. Chemists have been brought in and mechanical engineers have been consulted. Production methods involving the use of automatic machinery have been installed; and the likelihood is that metallurgists will be called in to cooperate with the chemists and platers.

Poisoning from Polishing

SOME attention has been paid lately in the daily press to the danger of poisoning from the use of silver polishes containing cyanides. Some of the common silver polishes for household use may contain cyanide which may constitute a danger to the people using them. As a general principle, it is stated that the Health Department recommends the use of other materials.

Cyanide has the property of forming compounds with silver which are soluble in water. It does, of course, afford an easy method of polishing tarnished silverware. This film can, however, also be removed by very fine polishing materials which eliminate the discoloration by abrasion, without scratches visible to the naked eye.

If care is used in the handling of polishes which contain cyanide, no injury should result; moreover, the injuries are not likely to be fatal, or even very serious, as this occurs only when cyanides are taken internally. However, it is quite definite that public favor should be more easily won by effective non-poisonous polishes.

Questions and Answers

All inquiries are answered in the order received and, whenever possible, the answers published in the next regular issue

Black Nickel and Chromium

Q.—I operate a plating plant in Australia and would like to have a formula for a black nickel solution. I would like full data, including cost.

Please give me a formula for chromium deposition also and method of operation.

A.—The formula for a black nickel solution that is in general use in the United States is as follows:

Double nickel salts	8 oz.
Sodium sulphocyanide	2 oz.
Zinc sulphate	1 oz.
Water	1 gallon

Temperature, 80° F. Cathode current density, 1 to 1.5 amperes per square foot.

The cost of the constituents for a solution of this type would be about 12 cents (U. S.) per gallon.

Formula for chromium solution:

Chromic acid	55 oz.
Sulphuric acid, C. P.	0.3 oz., by weight
Water	1 gallon

Temperature, 95° F. Cathode current density, 50 to 75 amperes per square foot. Use a glass-lined iron tank and 6 per cent antimony lead anodes.

With the price of chromic acid at about 20 cents a pound, it would cost approximately 70 cents a gallon to prepare this solution in the United States.

—Oliver J. Sizelove.

Chromium on Electrotypes

Q.—Can you give me any information on some of the difficulties I encounter in chrome plating in an electrotyping plant?

I have no trouble plating over nickel-plated work, but do over nickel types where the nickel is first plated on the wax or lead mold, and then backed up with copper. This nickel face takes at least three or four amps per square inch, whereas my nickel plated work takes only one and one-half amps per square inch.

My hardest problem is where I have a copper face electrotype with a nickel faced half tone or cut patched in. If I use low amperages, the copper part will take but the nickel part will not. If I use high amperages, the nickel part will take, but the copper part will burn or peal.

One firm is given the work a hot cyanide copper flash of 18 or 20 seconds before chrome plating.

Could you advise me what formula would be best to use for a cyanide bath of this kind? Would a cyanide flash stand up for a 30 minute run in a chrome bath?

My chromium solution contains:

	Per Gal.
Chromic acid	33 oz.
Chromium sulphate	0.4 oz.
Chromium carbonate	1.0 oz.

I have tried a cyanide copper solution composed of—

	Per Gal.
Sodium cyanide	2 oz.
Copper cyanide	1½ oz.
Sodium carbonate	1 oz.
Caustic soda	¼ oz.

At 9 volts, a plate 10 x 14 inches hardly covers in 20 seconds to allow me to chrome plate without using high amperages, and if I leave it in the copper for 40 or 60 seconds the chrome will flake; or peel the copper off if I leave it in the chrome more than twenty minutes. I am using rolled copper for my anode. A plater told me if it does not work to add more copper cyanide.

A.—A little different temperature and current density is necessary to produce a bright deposit of chromium on nickel than what is required for copper. We would advise the use of the copper flash before chromium plating for your half tones.

The following formula will give good results.

Copper cyanide	3 oz.
Sodium cyanide	3½ oz.
Hyposulphite soda	1/32 oz.
Water	1 gallon

Temperature 110° F. Cathode current density, 12 to 15 amperes per square foot.

You should have no trouble in chromium plating upon this deposit for 30 minutes or longer.

—Oliver J. Sizelove.

Computing Surface Area of Jewelry

Q.—How can I compute the surface area of a number of gold or other rings when I wish to plate them properly and need to know what amperage to give them?

Is it necessary, in figuring the amperage, to allow some for the racks?

I would like to chromium plate some rings. Can you tell me about what amperage to give 6 or 12 rings plated at once?

Is the following a good nickel solution for a plate to precede the chromium deposit?

Water	1 gallon
Single nickel salts	12 oz.
Nickel chloride	1 oz.
Sal ammoniac	2 oz.
Boric acid	2 oz.

A.—In calculating area of rings, all surface measurements should be taken. In computing the necessary amperage required for a load of work the surface of the racks must also be considered unless the racks are insulated.

The amperage that is necessary to plate the rings depends greatly upon the type of chromium solution used.

The formula for nickel solution that you give will probably produce good results providing the pH is kept at 5.8 or 6.

—Oliver J. Sizelove.

Copper on Carbon Brushes

Q.—We are in the carbon brush business and have a copper plating bath for copper coating brushes which has been working satisfactorily for several years. In the last few weeks the bath has become very weak. We have added sulphuric acid, blue vitrol and water, but this has not overcome our difficulties.

Upon placing the carbon brushes in the bath, instead of taking a copper coating they become burnt, taking a dark, reddish color.

We would appreciate it very much if you could supply us with any information that would aid us in overcoming the difficulty.

A.—We would first advise you to check over the electrical connections at your copper plating tank. Possibly there are corroded, loose or dirty connections. Next, have your copper solution analyzed for copper sulphate concentration and free sulphuric acid. Your copper sulphate concentration should at least be 20 oz. per gallon and your free sulphuric acid at least 8 oz.

It is entirely possible that you have too great a concentration of sulphuric acid for copper sulphate concentration.

If you send information additional to the above, kindly send us a sample of your solution together with details of operation, such as voltage, current density, still or agitated solution, etc.

—Joseph Haas.

Copper Plate on Babbitt

Q.—Please let me have a formula for a solution for copper plating Babbitt metal. I have tried some things, but have not succeeded as yet. The Babbitt is No. 1, consisting of approximately 80 lead and 20 tin.

A.—Formula for copper solution:

Copper cyanide	4 oz.
Sodium cyanide	4½ oz.
Carbonate soda	2 oz.
Hyposulphite soda	1/32 oz.
Water	1 gallon

Temperature, 110° F.; cathode current density, 3 to 5 amperes per square foot.

To prevent blistering it is necessary to use a low free cyanide content with a low amperage.

The work should be freed from grease or oil by means of an alkaline cleaner, then scrubbed with pumice or wet scratch-brushed to remove the oxidation that is formed by the cleansing solution.

—Oliver J. Sizelove.

Data on Nickel Plating

Q.—I am sending samples of two nickel solutions marked No. 1 and No. 2 which I would like to have analyzed for metallic content, chloride and pH.

I am using cadmium sticks as brightener in No. 1, with fair results, but not just what I want. Too much time is required getting the work bright by cleaning and brushing after plating. The work has to be bright. It is handled in quantities. How can I get a good, bright plate easily?

Solution No. 2 gives trouble by gasing at the cathode. Pitting occurs at times, but not always.

A.—Analysis of nickel solution No. 1:

Metallic nickel	2.29 oz.
Chlorides	8.02 oz.
pH	5.6

The metal content and the pH are good, but the chloride content is entirely too high. If you are using nickel chloride, discontinue it. If the cadmium is used properly you should be able to produce a bright deposit, so that the inside would not have to be scratch brushed. If you had sent a sample of the work that was plated it would have aided greatly in answering your question.

Analysis of No. 2:

Metallic nickel	2.70 oz.
Chlorides	7.24 oz.
pH	5.8

In this solution the metal content and the pH are good, but the chloride content is too high. You can overcome the pitting by adding hydrogen peroxide to the solution, but we would not advise doing so if you wish a bright deposit.

—Oliver J. Sizelove.

Improving Zinc Solution

Q.—I have a solution made up of the following:

Zinc sulphate	1,000 lbs.
Sodium sulphate	150 lbs.
Aluminum sulphate	55 lbs.
Boracic acid	20 lbs.
Water (distilled)	600 gallons

This solution does not produce a very heavy deposit and a black smut forms on parts of the work. Can you tell me what causes the smut and why the solution will not produce a good heavy plate?

A.—It is quite difficult to give a satisfactory answer to your question with the little information you have given.

We suggest the addition of 2 ozs. of ammonium chloride and 2 ozs. of sodium acetate to each gallon of solution. If this does not help, add 15 fluid ozs. of sulphuric acid. You will be compelled to make small additions of sulphuric acid quite frequently. Operate the solution at a cathode current density of 20 amperes per square foot.

—Oliver J. Sizelove.

Nickel and Copper Solutions

Q.—We have a 360 gallon nickel solution that is giving us trouble and we are sending a sample for analysis. It crystallizes on the bottom and also on the work. It wipes off with a cloth, in flakes. The solution was idle for 8 or 9 months. How can it be brought back to normal?

We are sending a sample of a copper solution also which we would like to change to a golden copper color for electrical fixtures. What is necessary to make this change?

A.—Analysis of nickel solution:

Metallic nickel	5.32 oz.
Chlorides	9.79 oz.
pH	6.8

We suggest that you take one-half of the solution (180 gallons) from the tank, replenish with water and add 30 fluid ounces of C.P. sulphuric acid.

Analysis of cyanide copper solution:

Free cyanide	.05 oz.
Metallic copper	5.27 oz.

If you wish to convert your copper solution to a bronze, add ½ ounce of zinc cyanide and 2 ounces of sodium cyanide to each gallon of solution. You can vary the color of the deposit by operating the solution at different temperatures.

—Oliver J. Sizelove.

Nickel on Die Cast and Other Work

Q.—I am sending you a sample of my nickel solution for analysis and some pieces of copper wire used in this solution. You will notice how black they are; they get that way after about 10 minutes in the tank, and they leave black spots where they get near the surface of the work. Anything hung in the tank without the current being turned on will turn a red color, like copper. I have tried adding 2 oz. ammonium chloride to the gallon without doing much good. I use the solution cold. The bulk of the work is aluminum die castings, but when necessary I plate brass, steel, iron or any other metal in it. I have tried a high pH and a low pH, but the black spots still appear.

A.—Analysis of nickel solution:

Metallic nickel	3.09 oz.
Chlorides	6.17 oz.
pH	5.8

Analysis also shows solution to contain some copper and zinc. It is in such a poor condition that we would advise discarding it and making a new one.

If you use a special nickel solution for the die cast work and a regular nickel solution for the other work, you will obtain better results.

Formula for die cast nickel solution:

Double nickel salts	10 oz.
Sodium chloride	7 oz.
Boric acid	2 oz.
Sodium citrate	1 oz.
Water	1 gallon

Formula for regular nickel solution:

Double nickel salts	8 oz.
Single nickel salts	4 oz.
Boric acid	2 oz.
Sodium chloride	2 oz.
Water	1 gallon
pH	5.8

—Oliver J. Sizelove.

Nickel Plating Innovations

Q.—There has recently been brought to our attention a process for nickel plating that is new to us and regarding which quite some claims are made.

In view of your interest and work in the electroplating field, we would be greatly interested in obtaining your comments on it and for this purpose I am enclosing a list of claims and statements regarding it on the accompanying sheet.

What do you think of the bath as compared to any that are now in use, or known, say, from the standpoints of efficiency and economy of operation, as an undercoat for chromium or from any other angle?

A.—The trend of the times seems to be towards higher metal concentration in the various solutions, which allow a corresponding higher current density with the proper temperature, thereby producing deposits of a given thickness in considerably less time.

Some few years ago, Prof. Watts of the University of Wisconsin brought to the attention of the plating industry that it was possible to use a single nickel salt solution containing 32 ozs. of single nickel salt to a gallon of solution, and with the addition of nickel chloride and boric acid he was able to produce satisfactory deposits of nickel of a given thickness in considerably less time.

Today, in the automobile industry, nickel solutions are in operation that contain a still higher nickel concentration with excellent results.

With proper control methods, we see no reason why nickel solution of high metal concentration cannot be used satisfactorily. We would not consider this plating process as new and some of the statements should be checked also for accuracy, as, for instance, the current density claimed to be employed.

—Oliver J. Sizelove.

Nickel Under Chromium

Q.—We are sending you under separate cover four solutions taken from our four nickel plating tanks. Please analyze this and advise us if it is suitable for chrome plate or what changes would have to be made.

Also, please advise us if it is proper to wash the work and rinse it in a solution of muriatic acid before putting it in the nickel plating solution. This nickle plating is to be used on work before it is chrome plated.

A.—Analyses of nickel solutions:

1.	Metallic nickel	1.13 ozs.
	Chlorides	1.34 ozs.
	P. H.	6
2.	Metallic nickel	1.20 ozs.
	Chlorides	.42 oz.
	P. H.	5.8
3.	Metallic nickel	1.18 ozs.
	Chlorides	.49 oz.
	P. H.	5.6
4.	Metallic nickel	1.31 ozs.
	Chlorides	.35 oz.
	P. H.	5.4

All solutions are in very poor condition to produce a deposit of nickel which is to receive a subsequent deposit of chromium. We recommend the following additions to each gallon:

To No. 1 tank, 8 oz. single nickel salts, 1 oz. of sodium chloride.

To No. 2 tank, 8 oz. single nickel salts, 2 oz. sodium chloride.

To No. 3 tank, 8 oz. single nickel salts, 2 oz. sodium chloride.

To No. 4 tank, 7 oz. single nickel salts, 2 oz. sodium chloride.

To No. 4 tank also add 12 oz. of 26° ammonia to each 100 gallons of solution.

Operate solution at a temperature of 110° F., with cathode current density of 15 amperes per square foot.

A muriatic acid dip before nickel plating, followed by a clean water rinse, is considered proper procedure, although a cyanide dip may be used.

—Oliver J. Sizelove.

Alkaline Content Determination

Q.—One of our customers has sent us an inquiry regarding a product in pill form to be used in determining the strength or alkalinity of tank solutions of cleaners.

We understand that such a product is on the market but cannot locate any source of supply. We would very much appreciate it if you could give us some information on this product and advise us where it might be purchased.

A.—We are sorry to inform you that from all sources available to us, we have been unable to locate any method of determining the alkalinity of cleaners by means of a pill.

Your informant has probably been misled by the fact that there is a method of determining the acidity of pickling baths by means of pills.

—Joseph Haas.

Plating Die Castings

Q.—I am having difficulty nickel and chrome plating die castings made up of 95% zinc, 3% copper, 2% aluminum. My still nickel solution is as follows:

Water	1 gal.
Double nickel salts	8 oz.
Common salt	4 oz.
Epsom salt	1 oz.
Sodium citrate	2 oz.

The nickel deposit is good but must be agitated constantly to overcome burning in recessed parts; if allowed to remain still it burns badly with either high or low current. These castings weigh about ten pounds each.

A.—The trouble with your nickel solution is that it lacks metallic nickel and conductivity. To increase the metallic content, we suggest adding 16 ozs. single nickel salts to each gallon of the solution. To increase your conductivity, add 8 ozs. of sodium sulphate to each gallon. To overcome the effect of the increased metal concentration of your nickel solution upon the die castings, increase your sodium citrate concentration from 2 ozs. to the gallon to 6 ozs.

—Joseph Haas.

Plating Inside of Pot

Q.—We are having trouble nickel plating insides of copper pots in which there is a partition. The 50-50 solder used darkens when immersed in the plating solution. We have not been able to get a bright nickel plate in the inside of the pot.

Do you know of any process that will help us out of these two difficulties?

A.—Before you can successfully deposit nickel, or, in fact, any metal at all, upon the solder inside of your pots, the solder has to be clean and bright. This is accomplished by all hollowware manufacturers by scratching their ware on the inside with special care to bring the solder seams up bright.

To bring up a bright white deposit inside the pots, use an inside anode. This inside anode is a rod ¼ to ⅜ in. in diameter inserted in a hard rubber tube which is completely perforated to allow passage of the current from the anode to the inside of the pot. These anodes are preferably suspended into the pots from auxiliary anode rods 6 to 8 inches above the cathode rods and slightly to one side of them, with wires. Or, they may be connected from the regular anode rods and slung into the pots. This method will give you entirely satisfactory deposits inside of your pots.

—Joseph Haas.

Rustproof Cadmium Deposit

Q.—Please give me a formula for cadmium plating to rustproof steel stampings and forgings. I want to produce a plate .0005 inch. State current density, etc. I am a practical plater and have done a great deal of cadmium plating, much of which I could not call rustproof.

A.—Formula for cadmium solution:

Cadmium oxide	3 oz.
Sodium cyanide	9 oz.
Caustic soda	2 oz.
Water	1 gallon

Black molasses, 1/16 oz. per gallon, is used as a brightener.

Temperature, 85° to 90° F. Cathode current density, 15 to 20 amperes per square foot.

At a cathode current density of 20 amperes per square inch approximately 20 minutes will be required to deposit .0005 inch of cadmium.

—Oliver J. Sizelove.

Tin on Cadmium

Q.—We do a considerable quantity of cadmium plating on small articles and to get a bright finish we have given a flash plate of tin to the burnished cadmium.

There has been some question as to whether cadmium would absorb tin, as we have noticed that unless we have a comparatively heavy deposit we cannot be assured of protecting the cadmium. Can you possibly assist us in this matter?

A.—We are unable to give you any definite information on the question you ask. After consulting all data we have in reference to the absorption of one metal by another, we have failed to find that there is any chemical reaction that takes place when these two metals are in contact with each other. However, there is a possibility that there may be some reaction between these two metals that has not been noticed before and we suggest that you take this question up with the United States Bureau of Standards, Washington, D. C. We believe that they would be interested in this problem.

—Oliver J. Sizelove.

White Gold Strip

Q.—I have a lot of white gold with fire scale on it to strip and am using a pickle of oil of vitriol (sulphuric acid), water and potassium bichromate, after which I put the white gold in a strip of yellow prussiate of potassium, cyanide and phosphoric acid. If you have a better formula, please let me have it.

A.—To remove the fire scale use the following solution:

Sulphuric acid	12 oz.
Sodium bichromate	4 oz.
Water	1 gallon

The stripping solution is made as follows:

Yellow prussiate potash	2 oz.
Sodium cyanide	8 oz.
Rochelle salts	2 oz.
Water	1 gallon

Use at 150° F.; 6 volts; lead cathode.

—Oliver J. Sizelove.

Water for Nickel Solutions

Q.—I am sending you two bottles of water for analysis. One is marked "City Water" and the other "Well Water."

On a previous occasion, in asking for plating information, you advised me to add acid to offset the lime in the city water. I am again having trouble and wonder if the lime in the city water is causing it again.

I can use the well water for replenishing the nickel bath, but it would take too much for the rinse.

Would a filter help the nickel solution? I could make a filter out of a cast iron pump and some cloth lined with cotton. Perhaps I ought to boil the solution. I cannot boil it in the nickel tank because it is lined with tar or asphaltum painted with several coats of acid-proof paint. I can boil it in two 40-gallon barrels, in which I could boil it in several lots, using from 30 to 60 pounds of steam pressure, by passing the steam through the solution.

It seems that iron oxide forms on the nickel anodes. It has a coppery color. I have not been able to remove this very well. I have tried water, sand and brush without much success.

Should I remove sediment from the electro-strips for nickel? Green crystals form on the copper used as cathode. Will these affect the solution? What upkeep is necessary for this strip?

A.—Analysis has shown the city water to contain a small amount of calcium carbonate and quite a large amount of calcium chloride. The well water has a larger percentage of calcium carbonate than the city water and also a trace of chloride and some sulphur.

With the use of the city water for replenishing the solution and the well water for rinsing purposes, you should have no trouble. You may filter the solution as you suggested, but would not advise boiling.

If you use a 99 per cent nickel anode, you will not introduce as large a percentage of impurities into the solution as with a 95 per cent or 97 per cent anode.

It is not necessary to remove the sediment from the electro-strip. When it fails to produce results, discard and make a new one.

If you have any further trouble, send sample of nickel solution for analysis; also send a small piece of work that has been plated in the solution.

—Oliver J. Sizelove.

Associations and Societies

American Foundrymen's Association

HEADQUARTERS, 222 WEST ADAMS ST., CHICAGO, ILL.

Early Convention News

While it is as yet somewhat too early to render very accurate information as to the details of the next annual convention of the American Foundrymen's Association, which will take place at Cleveland Public Auditorium, Cleveland, Ohio, May 12 to 16, 1930, a statement has been issued to the effect that in the auditorium and its annex there will be practically unlimited facilities for exhibition and educational purposes. There will be rooms for both large and small meetings as well as for the large commercial exhibition of foundry equipment and supplies and the extensive technical and educational exhibition that is being arranged.

The Association is now carrying out a vote for ratification of certain amendments to the by-laws and, according to C. E. Hoyt, executive secretary, this ratification will provide larger revenue through a more satisfactory classification of the membership. The added revenue will help the convention as well as other activities of the Association such as the new publication described below.

The Association invites the cooperation of all members of the industry in furthering and advancing the science of foundry work through improved methods. This can be done through the contribution of personal experience and knowledge, by presenting papers, participating in discussions and in many other ways that will promote the technical interests of the industry. Foundrymen should especially attend the annual conventions and arrange to present papers or exhibits if possible.

Monthly Publication

The Board of Directors of the Association has unanimously approved a monthly publication of the American Foundrymen's Association in which shall be printed the Transactions, including papers and discussions at the annual conventions. It is felt that this will make available in convenient form for reading and distribution important papers and reports. The Transactions will also be available in bound volumes at cost of binding. The date of the first issue of the new publication will be January 15, 1930. The publication will take the place of the Quarterly Bulletin, the last number of which will be issued in November.

American Electroplaters' Society

HEADQUARTERS, CARE OF GEORGE GEHLING, 5001 EDMUND ST., PHILADELPHIA

Philadelphia Branch

HEADQUARTERS, CARE OF PHILIP UHL, 2432 NORTH 29TH STREET, PHILADELPHIA, PA.

Fifteenth Annual Banquet, November 23

The fifteenth annual banquet and educational session of the American Electroplaters' Society will take place Saturday, November 23, 1929, at McAlister's, 1811 Spring Garden Street, Philadelphia.

The session will begin at 3:00 p. m. and the banquet at 7:00 p. m. The chairman of this year's session is to be Dr. Hiram Lukens of the University of Pennsylvania. There will be a program of lectures by a number of authorities on electroplating and allied sciences. More complete details will be contained in the next issue.

Report on Research Fund

The report of the treasurer of the Research Fund of the American Electroplaters' Society for the year 1928-29, which ended May 31, shows that $6,421.16 was spent during that fiscal period. The balance as of June 1, 1929, was $4,539.35, as compared with $6,828.30 on hand June 1, 1928. The difference was due to the fact that receipts for the year were smaller than in the preceding year and also because more money was spent for the research work. The total receipts for the year were $4,050. One of the reasons for the decline in contributions was the fact that a number of subscribers to the fund paid up in full at the start and thus had their contributions credited to the 1927-28 total, although part of it might have been held

over for the 1928-29 year. The condensed financial report of the treasurer is as follows:

Research Fund. Treasurer's Financial Report

June 1, 1928 to May 31, 1929

RECEIPTS

June 1, 1928 Balance on hand	$6,828.30	
From subscribers	4,050.00	
Interest on bank deposits	82.21	
Total Receipts		$10,960.51

DISBURSEMENTS

W. P. Barrows (Salary)	$3,025.00	
H. L. Farber (Salary)	2,425.00	
W. P. Barrows (Travel Expense)	484.28	
H. L. Farber (Travel Expense)	384.82	
Printing Expense	45.00	
Compensation Insurance	44.56	
Treasurer's Bond Premium	12.50	
Total Expenses		6,421,16
Cash Balance in Treasury June 1, 1929..		$4,539.35

Convention News

A report from the Pittsburgh district states that there will be an air-minded delegation from that sector to the 1930 convention of the society, to be held at Washington, D. C., next July. According to the statement, some of the Pittsburgh branch members are planning to come to Washington in an airplane, the latest thing in transportation. Completee details of this are not available, but will be published as soon as they are in hand.

Newark Branch

HEADQUARTERS, CARE OF GEORGE REUTER, P. O. BOX 201, NEWARK, N. J.

Special Meeting

An open meeting of the Newark branch was scheduled for October 18, at which time this issue was about to go to press. George G. Hogaboom, an associate editor of THE METAL INDUSTRY, well-known electroplating expert, was the evening's speaker. His subject was "Brass Plating." A more complete report will be given in the next issue.

New York Branch

HEADQUARTERS, CARE OF JOHN E. STERLING, 2581 FORTY-SIXTH STREET, ASTORIA, L. I.

Dr. Pan Lectures at Meeting

A meeting of the New York branch of the American Electroplaters' Society was held on October 11, at which 90 were present, including a large delegation from the Newark branch.

Dr. L. C. Pan, who is instructor of the plating class of the College of the City of New York, was the speaker for the evening. Dr. Pan's talk on **What Happens at the Anode in a Chromium Plating Solution** was very interesting and brought forth much discussion on chromium plating. At the close of the meeting Dr. Pan was presented with a gold emblem of the Electroplaters' Society.

Messrs. Smith, Sievering and Sizelove of the Newark branch were called upon for a few remarks. Mr. Wagner of the Newark branch invited the members of the New York branch to attend an open meeting of the Newark branch, held on October 18, at which George B. Hogaboom, well-known plating expert, was the speaker of the evening. His subject was **Brass Plating.**

Joseph Haas to Speak

At the meeting of the branch on October 25, 1929, the chief speaker will be Joseph Haas, well-known plating expert and formerly instructor of the New York branch electrochemistry class. His subject will be **The Foreman Plater and His Job,** on which Mr. Haas is very well informed. A large attendance is expected and all platers and their friends interested in plating are urged to attend.

Rochester Branch

HEADQUARTERS, CARE OF CHARLES GRIFFIN, 24 GARSON AVENUE, ROCHESTER, NEW YORK

Open Meeting Held

The Rochester Branch held an open meeting at Poucer's Hotel, Rochester, September 27. There was a very good attendance and some fine addresses were heard.

Horace H. Smith, supreme president of the Society, was present and gave an interesting talk on the plans of the Society for the coming year.

Dr. Harold Work of the Aluminum Company of America, Pittsburgh, Pa., delivered an especially fine lecture on **Nickel and Chromium Plating of Alumnium.** A great many questions were asked and Dr. Work supplied the Rochester platers with much information as to deposition on aluminum. His talk was highly appreciated and he was given a rising vote of thanks for his valuable contribution to the meeting.

Frank C. Mesle and **S. P. Gartland,** past supreme presidents, were present and gave short talks.

Dr. E. B. Sanigar of Sheffield, England, first recipient of the Weston Fellowship of the American Electrochemical Society, under which he is now engaged in research on plating at Columbia University, was present. He gave a short talk on **Electroplating Methods in Great Britain.**

George B. Hogaboom, electroplating expert and an associate editor of THE METAL INDUSTRY, conducted his famous **Question Box** and as usual provided a great deal of interest and brought out much valuable information.

Annual Outing and Clam Bake

On Saturday, September 28, the Rochester Branch held its annual outing and clam bake at the Old Homestead on Irondequoit Bay. Sports of all kinds were carried on. The feature of the day was a ball game between President Reama's Red Wings and Vice-President Hart's Colts. The Reama team won after 11 innings but the game was disputed as the umpire was found unsatisfactory. Special mention should be made of the pitching of William Hart for the losers and the catching of Judson Elster for the winners. During the dinner and for the dancing that followed the Melody Boys Orchestra provided the music.

October Meeting at Syracuse

The October meeting of the Branch will be held at Syracuse, N. Y., Saturday evening, October 26.

Frank C. Mesle of Oneida, N. Y., will deliver a lecture on **Silver Plating.** All Syracuse platers are urged to attend the meeting.

—CHARLES GRIFFIN, Secretary.

Personals

George D. Colburn, has been elected a director, of the Club Aluminum Company, Chicago, Ill., replacing **H. N. Selling.** Mr. Colburn is manager of the aluminum division.

A. M. Leverich, for the past eight years representative in Wisconsin of Abrasive Company, Philadelphia, Pa., has resigned to become general manager of the new Camden, N. J., plant of the Rundle Manufacturing Company. Mr. Leverich was formerly with the Dodge Motor Company, Detroit. **J. D. Buckley,** Birmingham, will succeed Mr. Leverich.

Robert E. McGill has been appointed western manager and **Edward R. Brazel** has been appointed district manager of Aluminum Industries, Inc., with headquarters at the company's San Francisco branch offices. The company has branches in California at both San Francisco and Los Angeles.

The Roxalin Flexible Lacquer Company, Inc., announce the addition of **Norman Cudworth Cohn** to its technical staff. Mr. Cohn received his A. B., B. S. chemical engineering degrees from Columbia University. Since 1926 his sword arm has been winning bouts for his Alma Mater. In 1928 he was sent to Holland as a member of the United States Olympic sabre team. Just recently he was proclaimed the National Outdoor Sabre Champion, and now he joins Roxalin, to joust for further victories.

Business Reports in Brief

Chromium Engineering Corporation

Chromium Engineering Corporation of America, 132-134 West 22nd Street, New York City, has established a complete, modern job plating shop with facilities for electroplating in all its branches, and also a complete analytical laboratory for electrochemical work of all kinds. The company states that more than $30,000 has been expended for the plant, all equipment formerly on the premises having been removed. The company has extended an invitation to all interested parties to visit the plant and see it in operation, producing "Platchchrome" and other work. The shop is under the supervision of James L. Garde.

The chemical laboratory will house twelve chemical engineers under the supervision of Otto H. Loven, formerly with Bassick Company, Bridgeport, Conn. The laboratory is equipped with all facilities for analysis of solutions and all other work in connection with electroplating. Here, according to the company, all theories can be tried under practical working conditions, a complete battery of tanks having been installed for the purpose. The company is entering the general consulting field as well as specializing in work pertaining to chromium plating. Mark Weisberg, president of the company and chief chemical engineer of the organization, states that much research in electroplating will be carried forward.

Radio and Electrical Expositions

The sixth annual Radio World's Fair was held at Madison Square Garden, New York City, September 23 to 28, 1929. Of chief interest to the metal and finishing industries were the great number of radio parts that are made of non-ferrous metals and the wide variety of finishes that are employed as necessary scientific factors in construction as well as to beautify the interiors and exteriors of receiving apparatus. The field, as indicated by the exhibition, continues to grow and since the apparatus is made chiefly of metals, the consumption appears to be steadily gaining. This, of course, is true as well of the finishes. There were exhibits by several concerns that are well known to metal people, as follows:

Aluminum Company of America, Pittsburgh, Pa., which displayed aluminum products; Phosphor Bronze Smelting Company, Philadelphia, Pa., phosphor bronze and other alloys; Multi-Metal Wire Cloth Company, Inc., New York City, pure nickel and other woven wire; Tubular Rivet and Stud Company, New York City, rivets and riveting machinery; National-Harris Wire Company, Newark, N. J., resistance wire; Cornish Wire Company, New York City, and Dudlo Manufacturing Company, Fort Wayne, Ind., wire, wire products, coils, lighting arrestors, etc.

The National Electrical Exposition at Grand Central Palace, New York City, October 7 to 12, was similar to the radio show in its relation to the metal and finishing industries. There were hundreds of examples of the increasing use of non-ferrous metals in electrical production, and also very many applications of practically every finish known, from sprayed paint to chromium and cadmium plate. Naturally, the more common finishes predominated. Such finishes as nickel and copper plate, bronze effects, and many sprayed and lacquered surfaces abounded. Very notable was the display of Manning-Bowman and Company, Meriden, Conn., who showed chromium plated tableware of various kinds, electrified and otherwise. There were other displays that attracted the eye by their use of chromium.

Osborn Manufacturing Company, Cleveland, Ohio, will erect an addition, 49 x 106 ft.

Eureka Metal Finishing Company, Inc., has opened a plant at 1465 Long Avenue, Hillside, N. J.

The American Foundry Equipment Company, Mishawaka, Ind., is building an addition to its plant.

Chapman Valve Manufacturing Company, Indian Orchard, Mass., is contemplating a foundry addition.

Chase Brass and Copper Company, Waterbury, Conn., has opened a branch warehouse in Minneapolis.

Standard Brass and Manufacturing Company, Port Arthur, Tex., has increased capitalization to $100,000 to provide for improvements.

Cleveland Hardware Company, 4518 Lakeside Avenue, Cleveland, Ohio, has installed a die casting department in its Lakeside Avenue plant.

Universal Aviation Corporation, 300 N. Broadway, St. Louis, Mo., plans the construction of an airport development including hangars, shops, etc., here.

Gluntz Brass Foundry Company, Cleveland, Ohio, awarded contract for a one-story, 30 x 80 ft. machine shop. Estimated cost $40,000.

Baird Machinery Company, Stratford, Conn., has closed bids for a one-story plant, 120 x 180 ft. to cost $100,000 without machine tool requirements.

Plainville Casting Company, Plainville, Conn., has

awarded general contract for one-story foundry, to cost about $20,000 with equipment.

United Aircraft and Transport Company, Inc., E. Hartford, Conn., closed bids on a powerhouse 50 x 120 ft. Equipment will be placed later.

Rensselaer Valve Company, Troy, N. Y., has placed an order for the installation of Norblo dust collecting apparatus in its cleaning department.

Metalcraft Products Company, Philadelphia, Pa., manufacturer of radiator covers, etc., has leased space in a building at 414 Arch Street, for local works and headquarters.

American Foundry Company, Inc., Alameda, formerly the American Foundry Company of Bay Point, Calif., has removed its plant and offices to Clement Avenue and Oak Street, Alameda.

Mitchell and Mitchell Manufacturing Company, Fort Smith, Ark., manufacturer of metal hospital bedsteads, springs, metal stampings, etc., will rebuild part of its plant recently destroyed by fire.

Detroit Aircraft Corporation, Detroit, Mich., has taken title to a 30-acre tract at Long Beach, Cal., for a new plant for parts production and assembling, to cost over $100,000 with equipment.

Line Material Company, South Milwaukee, Wis., manufacturer of metal and composition materials for electric transmission lines, will close bids shortly for a new building, three stories, 60 x 120 ft.

United Brass and Aluminum Manufacturing Company, South Park Street, Port Huron, Mich., will rebuild that portion of plant recently damaged by fire. Estimated loss was about $30,000.

Airways and Aircraft Company, Pittsburgh, Pa., has plans for airport development at Dravosburg, Pa., including hangars and other mechanical field units, to cost more than $85,000 with equipment.

Master Electric Company, Dayton, Ohio, manufacturer of motors, awarded a contract for the construction of an office building and foundry addition. Estimated cost is $150,000.

Bagues, Inc., 25 West Fifty-fourth Street, New York, manufacturer of wrought iron and bronze products, has leased part of the building at 333 West Fifty-second Street for a new plant.

Providence Insulated Wire Company, 65 Wadsworth Street, Providence, R. I., has awarded general contract for a two-story addition, 40 x 72 ft., to cost about $25,000 with equipment.

John Harsch Bronze and Foundry Company, Cleveland, Ohio, states that it does not intend to build a new plant in the near future, as reported elsewhere. The company will not build for at least two years.

Multiplex Faucet Company, St. Louis, Mo., has awarded general contract for a one-story top addition to plant, 80 x 80 ft., to cost about $30,000, with equipment. **J. J. Fitzgibbon** is treasurer.

Pease and Curran, 104 Point Street, Providence, R. I., operating a metals refining plant, have awarded general contract for a one-story addition, 55 x 100 ft., to cost about $35,000 with equipment.

Premier Foundry Company has moved from North Bergen, N. J., to 316 Bergen Turnpike, Little Ferry, N. J. The company operates non-ferrous foundry, 40 x 100 ft., and gray iron foundry, 25 x 100 ft. It also does plating.

Phenix Brass Foundry, Danvers, Mass., was damaged by fire recently causing a loss estimated at $15,000. The plant was a two-story wooden frame building and was owned by **James F. Alexander** of Danvers.

Western Foundries, Ltd., has purchased a four-acre site at Lethbridge, Alberta, and is erecting a plant to manufacture highway machinery, oil and mine drilling equipment, cast iron water pipe, brass and bronze castings, etc.

Sterling Grinding Wheel Company, Tiffin, Ohio, manufacturer of grinding wheels and other abrasive materials, has asked bids on general contract for a one-story addition to cost about $45,000 with equipment.

Chicago Air Service, Inc., operating Sky Harbor flying field, Glencoe district, Chicago, Ill., has leased a six-story building at Eighteenth Street, and South Michigan Avenue, for aircraft manufacturing plant and aviation school.

Air Industries Foundry, recently organized at Wichita, Kan., has moved to a new building at 701 E. Ninth Street. Special castings for aircraft construction are featured. **Lloyd Stearman** is president and **S. S. Pierce** general manager.

The Brewer-Titchener Corporation, Cortland, N. Y., manufacturer of automotive parts, has awarded a contract for the design and construction of three new units, constituting a plant expansion costing about $225,000.

Wilson and Nutwell, 140 Callish Street, Fresno, Calif., manufacturers of non-ferrous castings, reports business good. This company took over the foundry of the **Lisenby Manufacturing Company,** Fresno, Calif., about a year ago and since that time has added a pattern shop to the plant.

Lester A. Hicks has opened a brass foundry and builders hardware factory at 1736 Standard Avenue, Glendale, Calif., under the name of **L. A. Hicks Manufacturing Company.** Mr. Hicks formerly was president of the **Pacific Hardware Manufacturing Company,** Los Angeles.

Pittsburgh Metal Airplane Company, Pittsburgh, Pa., will increase facilities for the manufacture of all-metal cabin aircraft. The company has recently acquired **Thaden Metal Aircraft Company,** San Francisco, which has been removed to Pittsburgh, where production will be concentrated.

Ellison Bronze Company, Inc., a New York corporation, with its principal office in Richmond, Va., has been granted a charter, to manufacture and produce brass, bronze and metal castings. Maximum capital stock is $60,000. **Henry W. O'Grady** is agent in charge of business.

Samson-United Corporation, Rochester, N. Y., has been formed to take over the business of the Samson Cutlery Company there. Company's policies and activities will be continued, the reorganization providing resources for expansion to care for the company's expanding business

St. Louis Motor Valve Company, Inc., St. Louis, Mo., will establish a sales office in New York City at 246 Fifth Avenue, to handle eastern business. The office will be in charge of **Arthur B. Schellenberg.** The company manufactures motor-operated valve mechanisms, temperature control and pressure regulation apparatus.

The Roxalin Flexible Lacquer Company, Inc., has recently opened a branch office at 230 East Ohio Street, Chicago, Illinois. **Milford H. Corbin,** who has been associated with the technical staff, is in charge.

This branch will render a full technical service to middle western accounts and also deliveries of Roxalin products, which will be warehoused in Chicago.

Lasalco, Inc., St. Louis, Mo., manufacturers of plating and polishing equipment and supplies, have extended their manufacturing space, the addition doubling the firm's facilities. The extension takes care of continued expansion in demand for the company's products, particularly providing for increased output of plating and burnishing barrels. The address, formerly 2828-38, is now 2822-38 LaSalle St.

Howard E. Blood, president of **Norge Corporation,** manufacturers of the Norge electric rotary refrigerator, and now a division of the **Borg-Warner Corporation,** announces that Norge has now acquired new manufacturing facilities. The Norge Manufacturing operations are now being moved into the Detroit plants of **Morse Chain Company,** another subsidiary of Borg-Warner Corporation, where Norge will have ample room for manufacturing and growth. This move is necessitated by the rapid growth of both the **Detroit Gear and Machine Company,** in whose plants the Norge manufacturing operations have heretofore been conducted, and the Norge Corporation itself, and it is part of the far-reaching plan of Borg-Warner Corporation to place Norge in an important position in the electric refrigeration industry. The new plant, of most modern construction, is being equipped with the most-up-to-date machinery, and will be ready for production purposes by November 1st.

New Companies

East River Brass Works (C. Goldenberg), 261 Broadway, New York, has been incorporated for $50,000.

Everware Nickel Plating and Chromium Company, Wm. Turshen, 16 Court Street, Brooklyn, N. Y., has been incorporated for $10,000.

Union Metals Company, Inc., metal products, Rahway, N. J.; incorporated with 2,500 shares common stock.

Apex Brass Foundry Company, 1925 Elston Avenue, Chicago. Ill., has been incorporated with $5,000 capital by Arthur Goldberg, to engage in the foundry and machine shop business.

Hoes and Gropp Manufacturing Company, Inc., Indianapolis, Ind.; capital stock of 250 shares, having a par value of $100,000; to manufacture and sell all varieties of metal spinnings and metal specialties.

Chicago Rolling Mills, 229 N. LaSalle Street, Chicago, Ill.; capital 300,000 non par value; to manufacture and sell forms and combinations of iron, steel and other metals. This company can be addressed in care of Chapman and Cutler, 111 West Monroe Street, Chicago, Ill.

Sylentlyte Corporation, New York; capital, 600 shares of no par value common stock; to import automobile bodies made by Hibbard and Darrin, Paris, France. The bodies are made entirely of Bohn aluminum. Later they may be manufactured in the United States. Offices of the company are at 20 East Fifty-seventh Street, New York City, but temporarily all communications should be addressed to **W. M. Wright,** 71 Broadway, New York.

Trade Publications

The Life of Your Roof Hangs by a Nail. Copper and Brass Research Association, 25 Broadway, New York City. Leaflet on copper nails.

The Balancing of Grinding Wheels. Norton Company, Worcester, Mass. Technical material on use of abrasive wheels; 24-page booklet.

Pickl-Aide. The Weaver Brothers Company, Adrian, Mich. Small note-book, with some data relative to pickling, etc.

Duriron Kettles and Tanks. The Duriron Company, Inc., Dayton, Ohio. Leaflet on non-corrosive equipment.

Factors Affecting Grinding Wheel Selection. Norton Company, Worcester, Mass. A well printed booklet providing data that should be of importance to users of abrasives.

Bristol's Recording Psychrometers. The Bristol Company, Waterbury, Conn. Catalog No. 2100; mechanisms for recording and controlling relative humidity. Well illustrated.

Workmen's Safety Committees. Metropolitan Life Insurance Company, New York. Methods of organizing and conducting safety committees. This is No. 5 of the "Industrial Safety" series.

Type-T Weldite Rods. Fusion Welding Corporation, 103rd Street, Chicago, Ill. A new alloy welding rod for applying wear-resistant surfaces from gas or electric welding. Illustrated pamphlet.

Chemical Facts Instantly Available. D. Van Nostrand Company, Inc., 250 Fourth Avenue, New York City. Catalog of technical books on various subjects, including enameling, lacquering, etc.

Electricity for Industrial Heating. Commonwealth Edison Company, Chicago, Ill. Handsome illustrated brochure filled with illustrations showing many uses of electric heat in industry, such as melting and heat treating of metals, core baking, etc.

Columbia Electro Plating Generators. Columbia Electric Manufacturing Company, 1292 East 53rd Street, Cleveland, Ohio. Well illustrated, 16-page bulletin describing in detail the company's plating generators. All features of construction are described and full data included.

General Electric Company, Schenectady, N. Y. publications: **Electric Furnaces,** 20-page illustrated booklet showing various industrial applications; **Electric Heat in Industry,** a 48-page bulletin which illustrates application of electric heat to groups of basic operations commonly found in industrial plants; **Motor Drives for Rolling Mills,** partial list of main roll motors, 64 pages, illustrated; **Textolite Laminated,** leaflet on a product made of paper, cloth and resin, with great endurance properties; **Other Leaflets:** Enclosed Magnetic Switches; Strip Heaters; Synchronous Motors for Pumping; Heating Equipment for Electrotype Metal; Cartridge-Type Electric Heating Units.

Metal Prices, October 21, 1929

NEW METALS

Copper: Lake, 18.125. Electrolytic, 18.00. Casting, 17.25.
Zinc: Prime Western, 6.70. Brass Special, 6.75.
Tin: Straits, 40.375. Pig, 90%, 39.75.
Lead: 6.70. **Aluminum,** 24.30. **Antimony,** 8.625.
Nickel: Ingot, 35. Shot, 36. Elec. 35. Pellets, 40.
Quicksilver: flask, 75 lbs., $125. **Bismuth,** $1.70.
Cadmium, 95. **Cobalt,** 97%, $2.60. **Silver,** oz., Troy, 49.75.
Gold: oz., Troy, $20.67. **Platinum,** oz., Troy, $62.00.

INGOT METALS AND ALLOYS

Brass Ingots, Yellow	12¾to14
Brass Ingots, Red	15¾to16¾
Bronze Ingots	16¾to20
Casting Aluminum Alloys	21 to24
Manganese Bronze Castings	27 to39
Manganese Bronze Ingots	14 to20
Manganese Bronze Forgings	35 to43
Manganese Copper, 30%	28 to40
Monel Metal Shot	28
Monel Metal Blocks	28
Parsons Manganese Bronze Ingots	16½to19¾
Phosphor Bronze	17 to21
Phosphor Copper, guaranteed 15%	21½to25
Phosphor Copper, guaranteed 10%	20½to24
Phosphor Tin, no guarantee	50 to65
Silicon Copper, 10%, according to quantity	30 to25

OLD METALS

Buying Prices		Selling Prices
15½to15¾	Heavy Cut Copper	16½to16¾
14¾to15	Copper Wire, Mixed	15¾to16
12¾to13½	Light Copper	13¾to14½
12¼to12¾	Heavy Machine Composition	13¼to13¾
8¼to 9	Heavy Brass	9¼to10
7 to 7½	Light Brass	8 to 8½
9½to10	No. 1 Rod Brass Turnings	10½to11
11¼to12	Composition Turnings	12¼to13
5⅜to 5¾	Heavy Lead	6⅜to 6¾
3 to 3½	Zinc Scrap	4 to 4½
8 to 8½	Scrap Aluminum Turnings	9 to 9½
11 to12	Scrap Aluminum, cast alloyed	16 to17
16½to18	Scrap Aluminum sheet (new)	18½to20
26 to28	No. 1 Pewter	31 to34
20 to21	Old Nickel Anodes	22 to23
20 to23	Old Nickel	22 to25

Wrought Metals and Alloys

COPPER SHEET

Mill shipment (hot rolled) .....27¾ to 28¾c. net base
From Stock .....28¾ to 29¼c. net base

BARE COPPER WIRE

19⅝c. to 19⅞c. net base, in carload lots.

COPPER SEAMLESS TUBING

29¼c. to 30¼c. .net base.

SOLDERING COPPERS

300 lbs. and over in one order .....26¼c. net base
100 lbs. to 200 lbs. in one order .....26¾c. net base

ZINC SHEET

Duty on sheet, 2c. per lb. Cents per lb.
Carload lots, standard sizes and gauges, at mill, less 7 per cent discount .....10.50 net base
Casks, jobbbers' price .....10.75 net base
Open casks, jobbers' price .....11.25 to 11.75 net base

ALUMINUM SHEET AND COIL

Aluminum sheet, 18 ga., base, ton lots, per lb. 33.30
Aluminum coils, 24 ga., base, price 31.00

ROLLED NICKEL SHEET AND ROD

Net Base Prices

Cold Drawn Rods	53c.	Cold Rolled Sheet	60c.
Hot Rolled Rods	45c.	Full Finished Sheet	52c.

BLOCK TIN SHEET

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more 10½c. over Pig Tin; 50 to 100 lbs., 15c. over; 25 to 50 lbs., 17c. over; less than 25 lbs., 25c. over.

SILVER SHEET

Rolled sterling silver 51.50c., Troy oz., upward according to quantity.

BRASS MATERIAL—MILL SHIPMENTS

In effect April 16, 1929.
To customers who buy 5,000 lbs. or more in one order.

	Net base per lb. High Brass	Low Brass	Bronze
Sheet	$0.23¼	$0.25	$0.26¼
Wire	.23¾	.25½	.26¾
Rod	.21¼	.25¾	.27
Brazed tubing	.30⅞	....	.35⅞
Open seam tubing	.31¼	....	.34¼
Angles and channels	.31¼	....	.34¼

BRASS SEAMLESS TUBING

28¼c. to 29¼c. net base.

TOBIN BRONZE AND MUNTZ METAL

Tobin Bronze Rod ..... .25¾c. net base
Muntz or Yellow Metal Sheathing (14"x48")... .24c. net base
Muntz or Yellow Rectangular sheet other Sheathing ..... .25c. net base
Muntz or Yellow Metal Rod ..... .22¼c. net base
Above are for 100 lbs. or more in one order.

NICKEL SILVER (NICKELENE)

Net Base Prices

Grade "A" Sheet Metal		Wire and Rod	
10% Quality	31⅜c.	10% Quality	34⅛c.
15% Quality	33c.	15% Quality	37¾c.
18% Quality	34¼c.	18% Quality	41c.

MONEL METAL SHEET AND ROD

Hot Rolled Rods (base)	35	Full Finished Sheets (base)	42
Cold Drawn Rods (base)	40	Cold Rolled Sheets (base)	50

BRITANNIA METAL SHEET

No. 1 Britannia—18" wide or less, No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 8c. over N. Y. tin. price; 100 lbs. to 500 lbs., 10c. over; 50 to 100 lbs., 15c. over; 25 to 50 lbs., 20c. over; less than 25 lbs., 25c. over. Prices f. o. b. mill.

Supply Prices, October 21, 1929

ANODES

Copper: Cast	28c.	per lb.
Rolled, oval	27c.	per lb.
Rolled, sheets, trimmed	27¾c.	per lb.
Brass: Cast	27c.	per lb.
Zinc: Cast	12⅝c.	per lb.

Nickel: 90-92%	45c. per lb.
95-97%	47c. per lb.
99%	49c. per lb.

Silver: Rolled silver anodes .999 fine are quoted from 53c. per Troy ounce upward, depending upon quantity.

FELT POLISHING WHEELS WHITE SPANISH

Diameter	Thickness	Under 100 lbs.	100 to 200 lbs.	Over 200 lbs.
10-12-14 & 16"	1" to 3"	$3.00/lb.	$2.75/lb.	$2.65/lb.
6-8 & over 16	1 to 3	3.10	2.85	2.75
6 to 24	Under ½	4.25	4.00	3.90
6 to 24	½ to 1	4.00	3.75	3.65
6 to 24	Over 3	3.40	3.15	3.05
4 up to 6	¼ to 3	4.85	4.85	4.85
4 up to 6	Over 3	5.25	5.25	5.25
Under 4	¼ to 3	5.45	5.45	5.45
Under 4	Over 3	5.85	5.85	5.85

Grey Mexican Wheel deduct 10c per lb. from White Spanish prices

COTTON BUFFS

Full Disc Open buffs, per 100 sections.

12" 20 ply 64/68 Unbleached	$28.27to$28.30
14" 20 ply 64/68 Unbleached	36.45to 37.34
12" 20 ply 80/92 Unbleached	31.25to 34.16
14" 20 ply 80/92 Unbleached	42.40to 46.09
12" 20 ply 84/92 Unbleached	36.60to 42.50
14" 20 ply 84/92 Unbleached	49.60to 57.43
12" 20 ply 80/84 Unbleached	38.35to 39.37
14" 20 ply 80/84 Unbleached	52.00to 53.12
Sewed Pieced Buffs, per lb., bleached	52c to 71c.

CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone	lb.	.14-.19
Acid—Boric (Boracic) Crystals	lb.	.08½
Chromic 75 to 400 lb. drums	lb.	.19½-.21
Hydrochloric (Muriatic) Tech., 20°, Carboys	lb.	.02
Hydrochloric, C. P., 20 deg., carboys	lb.	.06
Hydrofluoric, 30% bbls.	lb.	.08
Nitric, 36 deg., carboys	lb.	.06
Nitric, 42 deg., carboys	lb.	.07
Sulphuric, 66 deg., carboys	lb.	.02
Alcohol—Butyl	lb.	.16¾-.21¼
Denatured, drums	gal.	.50-.60
Alum—Lump, Barrels	lb.	.03¼
Powdered, Barrels	lb.	.039
Aluminum chloride solution in carboys	lb.	.06½
Ammonium—Sulphate, tech., bbls.	lb.	3.3
Sulphocyanide	lb.	.65
Arsenic, white, kegs	lb.	.05
Asphaltum	lb.	.35
Benzol, pure	gal.	.60
Borax Crystals (Sodium Biborate), bbls.	lb.	.04½
Calcium Carbonate (Precipitated Chalk)	lb.	.04
Carbon Bisulphide, Drums	lb.	.06
Chrome Green, bbls.	lb.	.25
Chromic Sulphate	lb.	.30-.40
Copper—Acetate (Verdigris)	lb.	.23
Carbonate, bbls.	lb.	.21½
Cyanide (100 lb. kegs)	lb.	.45
Sulphate, bbls.	lb.	6.7
Cream of Tartar Crystals (Potassium Bitartrate)	lb.	.27
Crocus	lb.	.15
Dextrin	lb.	.05-.08
Emery Flour	lb.	.06
Flint, powdered	ton	$30.00
Fluor-spar (Calcic fluoride)	ton	$70.00
Fusel Oil	gal.	$4.45
Gold chloride	oz.	$12.00
Gum—Sandarac	lb.	.26
Shellac	lb.	.59-.61
Iron Sulphate (Copperas), bbl.	lb.	.01½
Lacquer Solvents	gal.	.85
Lead Acetate (Sugar of Lead)	lb.	.13¼
Yellow Oxide (Litharge)	lb.	.12½
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.58
Nickel—Carbonate, dry, bbls.	lb.	.35
Chloride, bbls.	lb.	.20
Salts, single, 300 lb. bbls.	lb.	.13
Salts, double, 425 lb. bbls.	lb.	.13
Paraffin	lb.	.05-.06
Phosphorus——Duty free, according to quantity	lb.	.35-.40
Potash, Caustic Electrolytic 88-92% broken, drums	lb.	.093
Potassium Bichromate, casks (crystals)	lb.	.09¼
Carbonate, 96-98%	lb.	.06¾-.07
Cyanide, 165 lb. cases, 94-96%	lb.	.57½
Pumice, ground, bbls.	lb.	.02½
Quartz, powdered	ton	$30.00
Rosin, bbls.	lb.	.04½
Rouge, nickel, 100 lb. lots	lb.	.25
Silver and Gold	lb.	.65
Sal Ammoniac (Ammonium Chloride) in casks	lb.	.05½
Silver Chloride, dry, 100 oz. lots	oz.	.42½
Cyanide (fluctuating)	oz.	.52½-.57½
Nitrate, 100 ounce lots	oz.	.36½
Soda Ash, 58%, bbls.	lb.	.02½
Sodium—Cyanide, 96 to 98%, 100 lbs.	lb.	.18
Hyposulphite, kegs	lb.	04
Nitrate, tech., bbls.	lb.	.04¾
Phosphate, tech., bbls.	lb.	.03¾
Silicate (Water Glass), bbls.	lb.	.02
Sulpho Cyanide	lb.	.32½
Sulphur (Brimstone), bbls.	lb.	.02
Tin Chloride, 100 lb. kegs	lb.	.36
Tripoli, Powdered	lb.	.03
Wax—Bees, white, ref. bleached	lb.	.60
Yellow, No. 1	lb.	.45
Whiting, Bolted	lb.	.02½-.06
Zinc Carbonate, bbls.	lb.	.11
Chloride, casks	lb.	.06¾
Cyanide (100 lb. kegs)	lb.	.41
Sulphate, bbls.	lb.	.03½